Challenges in Identifying Effects and Determinants of Corporate Tax Avoidance

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Vorwort

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Köln, im Februar 2018 *Birgit Hüsecken*

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Chapter 1

Introduction

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1.1 Motivation and Object of Research

It is widely known that tax effects are, in general, hard to identify despite being important to corporations (Frank and Goyal, 2009; Hennessy and Whited, 2005). Yet, the relevance of taxes is indisputable as corporations worldwide engage in various tax avoidance strategies extending from rather unexciting deferral of taxes to highly aggressive tax shelter participation and thereby, lowering their foreign tax rate to low one-digit numbers (Donohoe, McGill, and Outslay, 2012). Thus, well-founded tax research is indispensable.

In recent years, media coverage has once more accentuated the need for knowledge about taxes and especially tax avoidance of corporations. Famous examples include Google Inc. employing the widely discussed "Double Irish" and "Dutch Sandwich" structure and Starbucks Corp. shifting its UK income to low-tax jurisdictions for years.[1] Besides those reports about selected – mostly U.S. – corporations, secret tax documents of over 300 multinational corporations (MNCs) have been released by the International Consortium of Investigative Journalists (ICIJ) in 2014.[2] The revealed advance tax rulings (ATRs) offered refined tax structures secured by Luxembourg's tax authority. Two years later, the Panama Papers have been published uncovering information about further efficient tax avoidance structures.[3] Whether illegal or legal – note that tax avoidance is usually legal –, the reduction of corporate taxes generally evokes a public picture of unfairness. It does not only draw the attention of the public but also of fiscal authorities and governments (Bozanic, Hoopes, Thornock, and Williams, 2016), because it is incompatible with the original intention of tax law (Kadet, 2016).

[1] *Forbes* (2016, December 22), available at https://www.forbes.com/sites/robertwood/2016/12/22/how-google-saved-3-6-billion-taxes-from-paper-dutch-sandwich/#10ea35a91c19 and *The Guardian* (2015, December 15), available at https://www.theguardian.com/business/2015/dec/15/starbucks-pays-uk-corporation-tax-8-million-pounds.
[2] *ICIJ* (2014, November 5), available at https://www.icij.org/project/luxembourg-leaks/leaked-documents-expose-global-companies-secret-tax-deals-luxembourg.
[3] *The Guardian* (2016, April 5), available at https://www.theguardian.com/news/2016/apr/03/what-you-need-to-know-about-the-panama-papers.

Hindering corporate tax avoidance is thus an essential objective for policymakers. Consequently, corporations are confronted with strict domestic and international regulations (e.g. Desai, Dyck, and Zingales, 2007). For example, the U.S. regulators introduced FIN 48 in 2006 to increase the transparency on uncertain tax positions, i.e., unrecognized tax benefits (Blouin and Robinson, 2011) and through its base erosion and profit shifting (BEPS) project the Organization for Economic Cooperation and Development (OECD) released, amongst other measures, actions to align tax systems, restrain certain types of ATRs and increase transparency in tax reporting and transactions (OECD, 2015a). However, even though the implementation into national tax law is in progress, recent cases shed doubt on the success of BEPS and previous regulations.

In October 2015, the European Commission ruled – for the first time ever – on the question of illegal state aid in the cases of Fiat in Luxembourg and Starbucks in the Netherlands (European Commission, 2015). Not quite a year later, Apple's special tax deals in Ireland were also classified by the European Commission as illegal state aid resulting in $ 14.5 billion in back taxes.[4] Thus, not only MNCs are continuously criticized for their behavior, governments and fiscal authorities apparently did not act responsibly, either.

True to the motto know your enemy, regulators need to understand every detail in order to impede corporate tax avoidance. Why do MNCs pursue tax avoidance strategies, i.e., why do they oppose the public opinion and policymakers? Why do some corporations avoid taxes more effectively than others? And to what extent are other fiscal authorities involved in corporate tax planning? Especially since the call for more research on tax avoidance in the famous review by Hanlon and Heitzman (2010), researchers worldwide have attempted to provide answers to these questions.

[4] *The New York Times* (2016, August 30), available at http://www.nytimes.com/2016/08/31/technology/apple-tax-eu-ireland.html?_r=0.

As anecdotal evidence suggests, many corporations engage in tax avoidance. On the one hand, reducing the corporate tax liability through deferral or elimination obviously generates a substantial benefit as after-tax profits increase. On the other hand, tax avoidance may induce various costs including, but not limited to, firm risk, reputational concerns, and agency issues. Kim, Li, and Zhang (2011) find a higher stock price crash risk as a result of tax avoidance. Balakrishnan, Blouin, and Guay (2017) show increased information asymmetries and Hasan, Hoi, Wu, and Zhang (2014) provide evidence of negative effects on costs of bank capital. Therefore, corporations pursue tax planning strategies only if benefits exceed the risks (Blouin, 2014). This approach is in line with the general tradeoff theory suggesting that corporations weigh associated costs and benefits and subsequently adjust their level of tax avoidance (Kim, McGuire, Savoy, and Wilson, 2016). Put differently, they optimize their tax planning taking all related factors into consideration.

Another large strand of literature focusses on the determinants of tax avoidance. For example, subsidiaries in tax havens (Desai, Foley, and Hines, 2006) as well as international activities in general (Collins and Shackelford, 2003) facilitate tax planning. Other determinants include ownership structures (Chen, Chen, Cheng, and Shevlin, 2010), manager compensation (Armstrong, Blouin, and Larcker, 2012), labor unions (Chyz, Leung, Li, and Rui, 2013), and business models (Higgins, Omer, and Phillips, 2015). Furthermore, firm-specific characteristics taken from accounting data, such as size, profitability, or leverage, are shown to impact the level of tax avoidance (e.g. Gupta and Newberry, 1997; Plesko, 2003). It is obvious that previous literature has addressed many different factors regarding corporate tax avoidance and that it moved us closer to solving the central questions.

Nonetheless, it seems as if there are still significant knowledge gaps. Prior regulation attempts have not yet been sufficient as the corporate trend towards tax avoidance is still in full swing (Dyreng, Hanlon, Maydew, and Thornock, 2017). Various challenges in correctly and comprehensively identifying effects and determinants of corporate tax avoidance may be causal

for this research gap to which this thesis aims to contribute by addressing the following issues: ambiguities regarding the impact of determinants on tax avoidance, lack of sufficient disclosure about tax planning details, and weak as well as confounding effects.

First, despite having identified a battery of potential determinants, their actual impact and the specified magnitude of their influence on corporate tax avoidance is questionable. Many prior studies disregard the persistent part of the data over time and focus on changes only. However, as Hsiao (2003, p. 8) states "ignoring the individual […] specific effects that exist among cross-sectional […] units but are not captured by the included explanatory variables can lead to […] inconsistent or meaningless estimates of interesting parameters". This does not necessarily imply that known determinants are of little value. Yet, the explanatory power of the commonly employed ordinary least squares (OLS) regressions of pooled panel data (e.g. Chen et al., 2010; Higgins et al., 2015) should be enhanced by completing the set of variables.

Second, the publicly accessible data do not allow to capture all tax avoidance strategies a corporation engages in. The amount of tax relevant data disclosed by corporations is usually limited to what is required in the financial reports. Survey evidence suggests that managers refrain from voluntarily disclosing further information about tax structures as they fear the risk of tax litigations, negative media coverage, or customer boycotts (Graham, Hanlon, Shevlin, and Shroff, 2014). Additionally, as many countries take tax secrecy very seriously, information about how, if at all, governments and fiscal authorities are involved is treated as highly confidential and thus, not accessible. It is known that countries contend in drawing MNCs to their respective jurisdiction to increase their own benefits (Givati, 2009). However, publishing more detailed information may lead to undesired scrutiny into tax structures by other affected states. Acquiring normally hidden information could tremendously extend knowledge about tax avoidance practices.

Third, with regard to capital market effects of tax avoidance, it is necessary to understand that taxes often present only a small fraction of the available information. Hanlon and Slemrod

(2009) find only weak negative effects of tax shelter participation and Gallemore, Maydew, and Thornock (2014) have trouble identifying reputational effects. For empirical analyses, it is consequently beneficial if the respective object of investigation attracts lots of attention. But even if sufficient salience is given, it is often difficult to identify clear effects. Disentangling the many factors that impact firm value would straighten up ambiguous results.

Considering the just discussed challenges, the three essays presented in this thesis enhance the understanding of corporate tax avoidance through refined tax research. They show the importance and benefit of elaborate identification strategies as they include the usually unobserved time-invariant component and analyze the unique setting of Luxembourg Leaks (LuxLeaks). Such an exogenous shock can provide insight into otherwise unobservable aspects of tax avoidance. Secret ATRs have been released providing the market with unknown information about the MNCs tax avoidance and involvement of Luxembourg's fiscal authority. Furthermore, by analyzing LuxLeaks, which was accompanied with high media coverage, certain effects can be isolated as the disclosed ATRs provide the taxpayer with tax certainty about the agreed tax payments.

The first essay "The Undersheltering Puzzle and its Persistence over Time" is a single-author paper. Thus, apart from some recommendations on earlier versions, the complete essay is my sole responsibility. I investigate corporate tax avoidance over time and the reasoning behind its persistence. My results suggest a high impact of unobserved time-invariant firm-specific characteristics. Thereby, I can show that research in the context of tax avoidance needs to take into account this aspect of firm fixed effects to identify additional effects with greater confidence. The paper was presented at the Doctoral Research Seminar in Cologne 2017.

The second essay "Tax Avoidance through Advance Tax Rulings – Evidence from the LuxLeaks Firms" is co-authored by *Michael Overesch*, Chair of Business Taxation at the University of Cologne, who facilitated an exchange of structural ideas. I conducted the subsequent data collection and all empirical analyses. We analyze the influence of ATRs on

corporate tax avoidance and identify lower effective tax rates (ETRs) after the respective ruling. The unique setting of LuxLeaks enables us to explore priorly unknown aspects of tax avoidance. The paper was presented at the 39th European Accounting Association Annual Congress in Maastricht 2016, the 78. Jahrestagung des Verbandes der Hochschullehrer für Betriebswirtschaft in Munich 2016, and at the 72nd Annual Congress of the International Institute of Public Finance in South Lake Tahoe 2016.

The third essay "Effects of Disclosing Tax Avoidance: Capital Market Reaction to LuxLeaks" is co-authored by *Michael Overesch*, Chair of Business Taxation at the University of Cologne and *Alexander Tassius*, former doctoral research assistant at the Chair of Business Taxation at the University of Cologne. Based on a previously joint working paper, I was responsible for substantial revisions with regard to structural, formalistic, and empirical aspects. Examining also the event of LuxLeaks, we consider the capital market reaction and find some evidence for an increase in firm value after the unintended disclosure. Employing an event study design on this unique event provides the opportunity to gain knowledge about challenging effects of tax avoidance. The paper was presented at the Doctoral Research Seminar in Cologne 2016, the 6th EIASM Conference on Current Research in Taxation in Bonn 2016, the Zentrum für Europäische Wirtschaftsforschung Workshop in Mannheim 2016, the 3rd WU – Vienna University of Economics and Business Doctoral Seminar in Vienna 2016, the WHU – Otto Beisheim School of Management Research Seminar in Vallendar 2016, and the 40th European Accounting Association Annual Congress in Valencia 2017.

1.2 The Undersheltering Puzzle and its Persistence over Time

1.2.1 Research Question and Design

The first essay "The Undersheltering Puzzle and its Persistence over Time" investigates corporate tax avoidance over time and the reasoning behind persistent tax avoidance. Over the past decade, researchers worldwide aimed to provide an understanding of corporate tax

avoidance and answer the question of why some corporations avoid less taxes than others. The latter is generally dubbed the undersheltering puzzle (Weisbach, 2002). Literature has produced a number of determinants, such as the level of foreign activities and financial accounting data, which are supposed to explain the cross-sectional variation in tax avoidance implying that each corporation can reach any desired level of tax avoidance if those factors are adjusted accordingly. Nevertheless, some corporations appear to have better chances at reducing their ETRs as the common belief of tax unfairness and media coverage of certain U.S. MNCs suggest. One potential explanation for this phenomenon, which prior research seems to miss, is related to the dimension of time.

Dyreng, Hanlon, and Maydew (2008) as well as Guenther, Matsunaga, and Williams (2017) show some persistence of ETRs, i.e., an impact of current tax planning on future levels of tax avoidance. I expect to confirm their results. However, beyond the scope of previous research, I aim to raise awareness of this phenomenon and furthermore, show the reason for persistent tax avoidance. As many empirical studies disregard unobserved time-invariant firm-specific characteristics, I hypothesize that they determine a majority of the variation in corporate tax avoidance in a panel of firms and thus, explain the persistence over time.

First, I employ various explorative analyses to thoroughly introduce the aspect of persistence. I define persistent corporations as those corporations which report in the same level of the GAAP ETR distribution as before. This leads to roughly 50 % of my data being classified as persistent in terms of tax avoidance. As the amount is, however, a matter of definition, I apply alternative identification strategies of persistent corporations. Second, to empirically show the impact of firm fixed effects on corporate tax avoidance, I use two different sets of tests. On the one hand, I compare standard OLS regressions with fixed effects regressions. Thereby, I can identify changes in magnitude and significance of common determinants. On the other hand, I perform a variance decomposition with various model specifications revealing

the explanatory power of fixed effects. To assure the robustness of my results, I apply alternative measures of tax avoidance.

The empirical analysis is based on a dataset of U.S. corporations. The needed financial statement data is extracted from the database *Compustat North America* for the years 1987-2015 leading to a sample of over 9,000 firms.

1.2.2 Results and Contribution to the Literature

The explorative results suggest that there is persistence of tax avoidance. Even though perfect persistence does hardly exist, at least some corporations exhibit persistent ETRs. Their ETRs change considerably less over the years than the ETRs of other firms. Furthermore, I find evidence that the reason behind this persistence are firm fixed effects, i.e., unobserved time-invariant firm-specific characteristics generating a stable level of tax avoidance. Including this time-invariant factor in a variance decomposition highlights the importance regarding future identification strategies. 96.3 % of the explained variation in tax avoidance are attributable to firm fixed effects. Other common control variables and industry fixed effects appear to be rather irrelevant in comparison. Although I find some evidence that the latter represent one considerable aspect of the time-invariant effect. Furthermore, I show that the inclusion of firm fixed effects alters common determinants' point estimators by over one third of its original magnitude.

Prior literature has produced only limited evidence on the persistence of tax avoidance as it has not been the focus of those studies (Dyreng et al., 2008; Guenther et al., 2017). Abdul Wahab and Holland (2015) investigate with some more detail the persistence of book-tax differences. However, the reason for persistence remains – until today – unexplored. I can show that tax avoidance is driven by an unobserved time-invariant effect. By identifying this aspect, I add the dimension of time to the undersheltering puzzle and suggest an explanation for the invariable part of tax avoidance. Prior literature on the determinants of tax avoidance mostly considers only the smaller variable fraction.

Given the importance of the identified effect, prior identification strategies in the context of corporate tax avoidance are most likely misspecified. Following Hsiao (2003), drawn inferences from the commonly applied specifications can be inconsistent and meaningless. To identify the magnitude of effects with greater confidence the dimension of time cannot be neglected. These new results should also be of interest to policymakers as they gain new insight about corporate tax avoidance. If they ignore that some corporations hardly change at all irrespective of altering commonly known determinants, unsophisticated attempts of regulation might be in vain.

1.3 Tax Avoidance through Advance Tax Rulings – Evidence from the LuxLeaks Firms

1.3.1 Research Question and Design

The second essay "Tax Avoidance through Advance Tax Rulings – Evidence from the LuxLeaks Firms" analyzes the effect of engaging in ATRs on corporate tax avoidance of the respective MNCs. ATRs are offered in 32 of the OECD countries (OECD, 2013) and constitute agreements between a tax authority and a taxpayer about the application of tax law (OECD, 2015b). Thereby, they provide the MNC ex ante with tax certainty. Despite being legal in its nature, recent cases of ATRs appear to be agreements in which fiscal authorities secure sophisticated international tax avoidance structures to MNCs. These include for example transfer prices, hybrid financing, or disregarded entities, which are usually associated with a high risk of tax litigation (Dyreng, Hanlon, and Maydew, 2017). As a consequence, MNCs might refrain from these structures without ATRs. With ATRs, however, they lead with certainty to almost no tax payments (ICIJ, 2014a/2014b). Even though ATRs are of high interest for tax avoidance of MNCs, the effect and its extent are unexplored.

In 2014, the ICIJ posted a database of over 300 MNCs and their confidential tax documents about ATRs with Luxembourg's fiscal authority. This event, widely known as LuxLeaks, provides a unique setting to investigate the relationship of ATRs and tax avoidance.

Using the sample of exposed firms, we examine the additional tax avoidance of MNCs engaging in ATRs compared to MNCs that do not. As ATRs secure complex tax avoidance structures, we expect increases in worldwide tax avoidance after the ATR has been signed. We apply a fixed effects panel regression model with various control variables to measure the effect of engaging in an ATR by comparing the change in tax avoidance of MNCs that signed ATRs to the trend of the control group in the absence of ATRs. We use GAAP ETR as a well-established ex post measure of tax avoidance (e.g. Hanlon and Heitzman, 2010). A lower ETR implies higher tax avoidance. The variable of interest is basically an interaction term of MNCs that engage in ATRs and the effective period after the ruling, for which we consider the year after the ATR.

In addition to simple robustness checks, such as placebo tests and using CASH ETR and FOREIGN ETR as alternative tax avoidance measures, we further examine subsamples from different countries and exploit the durability of tax rulings by extending the period in which we believe it to be effective. Lastly, we combine propensity score matching and difference-in-differences estimation to mitigate the endogeneity concerns in our identification strategy. By selecting very similar MNCs, the only remaining difference is the decision to engage in an ATR and thus, the threat of spurious results is reduced.

For our empirical analyses, we combine the database of the ICIJ with consolidated financial statement data from *Compustat North America* and *Compustat Global*. Our data requirements lead to a sample of 136 MNCs that engaged in ATRs, issued and signed in Luxembourg between 2002 and 2010. To examine the change in tax avoidance, we include data from 2000 until 2014, leading to a control group of over 5,000 MNCs.

1.3.2 Results and Contribution to the Literature

The results of our main estimation indicate that MNCs significantly reduced their ETRs after engaging in an ATR. This implies that a single tax deal with one tax haven, i.e., in our case Luxembourg (Marian, 2017), affects the worldwide level of corporate tax avoidance. More

precisely, we identify a decline in GAAP ETR by about 4 percentage points attributable to the tax structure secured through a Luxembourg ATR. Our robustness tests lead to similar inferences with regard to significance and magnitude. Even though this is only a short-term effect, the economic magnitude becomes indisputable considering that over a three-year period the decline still amounts to 2 percentage points. Considering a mean corporate ETR of 28 %, the latter implies that MNCs reduced their taxes by 7 % through ATRs and thus, saved lots of taxes. Consequently, our results confirm our expectation that MNCs significantly reduce their ETR through Luxembourg ATRs.

Previous literature analyzes various tax planning structures (for an overview see Hanlon and Heitzman, 2010) and their impact on overall corporate tax avoidance (e.g. Dyreng and Lyndsey, 2009; Markle and Shackelford, 2012a/2012b). Through the additionally identified effect attributable to ATRs, our study provides first insight into tax avoidance under certainty as previously identified tax planning structures may be exploited in a more aggressive way if secured by fiscal authorities.

Moreover, our results are of interest to policymakers. By showing the reduction in ETRs after engaging in an ATR, our results suggest that ATRs may be used for tax abuse and offer a better understanding of the impact of ATRs on the scope of corporate tax avoidance. The results are in line with the BEPS initiative trying to increase tax transparency between countries and suppress exploitation of ATRs, as we confirm that fiscal authorities need to collaborate in order to hinder tax avoidance.

1.4 Effects of Disclosing Tax Avoidance: Capital Market Reaction to LuxLeaks

1.4.1 Research Question and Design

The final essay “Effects of Disclosing Tax Avoidance: Capital Market Reaction to LuxLeaks” scrutinizes the capital market reaction to disclosure of tax avoidance. Risk averse managers refrain from voluntary disclosure as they place high values on potential reputation

and litigation risks (Graham et al., 2014). Unintended disclosure, such as LuxLeaks, is also scarce as documents have to be leaked or gathered through intense scrutiny. Consequently, little is known about the effects of disclosing additional information. Providing the capital market with a realistic and credible picture of the MNC's tax planning, unintended disclosure should increase firm value because the reduction of taxes is associated with after-tax profits (Bryant-Kutcher, Guenther, and Jackson, 2012; Inger, 2014). However, Hanlon and Slemrod (2009) as well as Gallemore et al. (2014) find negative capital market reactions to the detection of tax shelters.

One reason for this negative effect may be the risk of tax litigations. If the disclosed tax avoidance structures are, on the contrary, legal and secured by fiscal authority, the level of litigation risk should be low. The unexpected dissemination of tax documents in the course of LuxLeaks on November 5th, 2014 perfectly matches this criterion. The involuntarily disclosed ATRs provide tax certainty. Thus, we might expect a positive capital market reaction as shareholders reward disclosure of tax structures which are associated with low litigation risks. Nevertheless, media condemned the involved corporations and Luxembourg's fiscal authority for drastically reducing corporate taxes on an industrial scale. If these news trigger significant and predominant reputational risks, the capital market reaction can also be negative.

LuxLeaks provides a unique setting through which we can identify clear effects as an event study design enables us to analyze the capital market reaction around the particular day. Considering each MNC's share prices and the development of the respective capital market, we calculate the cumulated abnormal returns (CARs) and investigate whether they differ significantly from zero. We test the robustness of our results by applying varying event window lengths, adjusted standard errors, and an alternative method to calculate the abnormal returns. Moreover, we distinguish between firms with different levels of corporate tax avoidance as we expect the capital market to react differently according to what image of tax aggressiveness the previously reported ETR evokes.

To perform our analyses, we gather data about sample firms from the database published by the ICIJ, stock prices and accounting data from *Compustat North America* and *Compustat Global*, and index price information from *Datastream*. To maximize the sample to 148 firms, or rather 103 firms in the analyses of CARs for different levels of tax avoidance, we fill in missing values with hand-collected data from consolidated financial reports.

1.4.2 Results and Contribution to the Literature

The results suggest a positive capital market reaction to the unintended disclosure of tax avoidance through LuxLeaks. Over a seven-day period around the event, the return of the sample firms was, on average, 1.22 percentage points higher than the market. Finding no negative effects, we can clearly conclude that reputational risks do not outweigh the positive effects. However, as not all specifications are robust to cross-sectional correlation, we infer only cautiously that market participants may reward credible disclosure of sophisticated tax avoidance structures. The inferences of our results are reinforced by our robustness tests as well as additional results regarding sample splits according to different firm characteristics. In our subsequent analyses, we find that the positive effect is especially pronounced for firms with extraordinarily high ETRs. This finding implies that the capital market values the unexpected information about a firm's commitment to sophisticated tax avoidance. Regarding low-ETR firms, we do not find a robust, positive capital market reaction.

Previous literature shows no mutual consent on the potential trend of disclosing additional information about tax avoidance on firm value. One strand of literature suggests a positive effect on firm value (e.g. Bryant-Kutcher et al., 2012). However, an increase in uncertainty may reverse the positive valuation (Drake, Lusch, and Stekelberg, 2017). A small strand of literature confirms this negative effect for the detection of tax shelters (e.g. Hanlon and Slemrod, 2009). As LuxLeaks disclosed information about ATRs associated with low litigation risks, we are the first to show that there is at least no negative or even a positive effect on firm value in such a setting.

With these results, we also contribute to the available literature on tax transparency. Lately, public scrutiny, such as in the case of Starbucks[5], increased disclosure (see also Dyreng, Hoopes, and Wilde, 2016). Additionally, policymakers try to increase the amount of tax information a corporation has to disclose. However, investors seem to reward low levels of disclosure as they shy away from providing the public with corporate details (Robinson and Schmidt, 2013). Nevertheless, we can show that credible disclosure about tax certainty is not detrimental and may even be beneficial for MNCs.

Lastly, the unique setting of LuxLeaks allows us to draw clearer conclusions with regard to reputational effects as we can – in contrast to previous research – eliminate the influence of litigation risk. Our rather positive capital market reaction suggests that reputational risks are balanced or even outweighed by positive effects. This is in line with prior studies highlighting that investors barely consider reputational concerns (Gallemore et al., 2014).

[5] *The Guardian* (2015, December 15), available at https://www.theguardian.com/business/2015/ dec/15/starbucks-pays-uk-corporation-tax-8-million-pounds.

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Chapter 2

The Undersheltering Puzzle and its Persistence over Time

The Undersheltering Puzzle and its Persistence over Time

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Abstract:

This empirical study analyzes persistence of tax avoidance. For decades, the well-known undersheltering puzzle, i.e., why not all firms equally engage in tax avoidance, has occupied tax research. Identifying common determinants and efforts by policymakers to hinder the reduction of taxes did not solve the problem. My results do not only confirm previous academic and common belief that some corporations always avoid more taxes than others, they furthermore identify a high impact of firm fixed effects. The majority of variation in tax avoidance in a panel of corporations is time-invariant. Thus, research can identify additional determinants and policymakers can change tax laws, the level of tax avoidance might nevertheless remain constant for these corporations.

Keywords: Tax Avoidance, Persistence, Fixed Effects, Undersheltering Puzzle

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2.1 Introduction

Exploiting loopholes in tax systems is perfectly legal, however, not every company equally engages in tax avoidance. Over the past decade, this so-called undersheltering puzzle (Weisbach, 2002) has become one of the fundamental questions in tax research. Why do some corporations avoid more taxes than others? Hanlon and Heitzman (2010) have called for more papers on the determinants of tax avoidance. Many attempts by researchers worldwide to answer this question have generated a number of factors that are supposed to explain variation in corporate tax avoidance. However, have those studies and the identified determinants really moved us toward solving the undersheltering puzzle? Given the multitude of determinants were decisive, how could it be possible to still enhance the academic knowledge about corporate tax avoidance to ultimately provide a more thorough understanding of undersheltering?

My goal in this paper is to address these questions. More precisely, I examine corporate tax avoidance over time to identify whether persistent corporations, whose level of tax avoidance stays the same, exist. In doing so, I can show that there is a certain persistence to the undersheltering puzzle. Though, more interestingly, I also investigate the reason behind persistent tax avoidance. Thereby, I am able to provide some understanding of what prior determinants seem to miss.

Previous research on the undersheltering puzzle contains the underlying assumption of tax avoidance being variable. Rational behavior as well as tradeoff theory suggest that corporations optimize their tax planning by weighing associated costs and benefits. This implies that each corporation can achieve any level of tax avoidance if desired. Academics find that, for example, if the ownership structure is adjusted (Chen, Chen, Cheng, and Shevlin, 2010), multinational activity in tax havens is increased (Dyreng and Lindsey, 2009), or profitability is changed (Rego, 2003), the level of tax avoidance will alter. The identified determinants are based on cross-sectional differences between firms. However, the aspect of time is not fully

included. My later analysis[6] depicts a picture in which it seems to be implausible that common determinants explain persistent tax avoidance. Mean tax avoidance appears to be rather constant whereas the determinants vary significantly. Therefore, beyond the scope of prior literature, I investigate the unobserved time-invariant effect.

Not only academic researchers, but also the general public as well as policymakers should be keen to learn more about the persistence of tax avoidance. Over the past years, it has always been the same couple of corporations enclosed in the headlines of worldwide news concerning the legal and potentially illegal reduction of taxes. Even though, a general trend towards tax avoidance exists (Dyreng, Hanlon, Maydew, and Thornock, 2017b), some corporations seemingly have a better chance of success in reducing their effective tax rates (ETRs). It appears as if there are some good and some bad corporations with regard to the reduction of tax payments. This reinforces the public opinion of tax unfairness and the criticism accompanied with it. National policymakers regularly make an effort to reduce this apparent unfairness of some corporations not paying their share of taxes by implementing new laws and regulations. Recently, several countries jointly produced actions to further restrain base erosion and profit shifting (BEPS) of multinational corporations. However, the gap between corporations is still economically meaningful and thus, requires further explanation.

Using a sample of 9,054 U.S. corporations from 1987 till 2015, I find that some corporations show persistent, i.e., they hardly deviate from their priorly reported, levels of tax avoidance. I define persistence as reporting in the same level of the tax avoidance distribution as before. More precisely, this means that the corporation belongs again to the 25 % of corporations with the highest (second highest, and so on) level of tax avoidance. I employ consolidated financial statement information from *Compustat North America* to calculate the respective tax avoidance measure. ETRs capture the overall level of tax avoidance including

[6] Cf. figure 2 in section 2.3.

any form of tax reduction. The results are consistent for different definitions of ETRs as well as alternative identification strategies of persistent corporations. Thereby, I can show that persistence is a phenomenon worthy to be further investigated. My subsequent analyses show that the reason behind persistence are firm fixed effects, i.e., unobserved time-invariant firm-specific characteristics determining the level of tax avoidance. As my results specify, one aspect thereof is the industry a corporation operates in. The relevance of firm fixed effects stands out in a parametric variance decomposition. 96.3 % of the explained variation in tax avoidance is attributable to firm fixed effects even if a battery of control variables is included in the same regression. The latter's influence decreases as coefficients are altered and lose statistical significance.

Although a complete answer to the undersheltering puzzle is also well beyond the scope of this paper, I nevertheless advance academic knowledge by investigating the persistence of tax avoidance. My paper offers several contributions. First, my results add to the available knowledge about general persistence of tax avoidance by raising awareness of this circumstance. Dyreng, Hanlon, and Maydew (2008) as well as Guenther, Matsunaga, and Williams (2017) show some persistence of ETRs which is especially pronounced for the highest levels of tax avoidance and Abdul Wahab and Holland (2015) find evidence on persistence of book-tax differences. Overall, I can confirm previous findings. However, I aim to offer a more comprehensive understanding of persistence while prior evidence is rather limited. Those studies' main focus is either the development of a new ETR measure (Dyreng et al., 2008) or the implications for firm risk (Guenther et al., 2017). This paper, on the contrary, focusses on persistence and the reasoning behind it. Economically speaking, this new evidence of persistence may also be of interest to policymakers who battle against tax avoidance. By providing a general understanding of persistence, I offer a new basis for anti-tax avoidance measures as persistent tax avoiders might have to be tackled differently or, more drastically speaking, might not change at all implying that any attempts of regulation could be in vain.

Second, I expand the available literature on costs and determinants of tax avoidance by adding the dimension of time to the well-known undersheltering puzzle. In addition to common determinants, such as size, profitability, multinational activities, or availability of intangible assets, time-invariant firm-specific characteristics need to be considered. Previous determinants can solely contribute to the undersheltering puzzle by explaining parts of the variable tax avoidance. However, a good part of the corporation's tax avoidance is not variable and thus, leads to a persistent level of tax avoidance. The identified influence of firm fixed effects suggests that some corporations can hardly adjust their level of tax avoidance, irrespective of associated costs and benefits of tax structures. Consequently, literature on costs of tax avoidance (e.g. cost of equity by Goh, Lee, Lim, and Shevlin (2016) or stock price crash risk by Kim, Li, and Zhang (2011)) might have to differentiate between persistent and non-persistent corporations. The same is true for the growing field of tax risk literature that finds mixed evidence on the association of tax risk and the level of tax avoidance (Dyreng, Hanlon, and Maydew, 2017a; Brooks, Godfrey, Hillenbrand, and Money, 2016). In additional analyses, my study shows that not all corporations are subject to high tax risk, as persistence significantly reduces the respective tax risk.

Third, my results are relevant to all prior and future analyses of determinants of tax avoidance. Given the importance of the unobserved time-invariant component, prior estimates that do not account for the firm-specific effect are likely misspecified. According to Hsiao (2003), it is questionable to draw inferences from those specifications as they might be inconsistent or meaningless. The inclusion of firm fixed effects (as a potential alternative to address omitted variables) enhances the common ordinary least squares (OLS) approach in order to identify marginal effects of determinants of tax avoidance with greater confidence. Moreover, more refined empirical setups may be needed to further enhance academic knowledge. Generally speaking, the examination of exogenous shocks might be the only source to learn more about the identified, but otherwise unobservable, effect.

The remainder of this paper proceeds as follows. Section 2.2 describes prior literature and develops the hypotheses. In section 2.3, I present the data and perform some explorative analyses. Section 2.4 explains the research methodologies and discusses the respective results. Section 2.5 concludes.

2.2 Hypotheses Development

Tax avoidance includes anything that reduces a corporation's taxes (Dyreng et al., 2008; Hanlon and Heitzman, 2010). Over the last couple of years, many researcher have investigated this broad concept with regard to determinants and consequences of tax avoidance. A common feature of the different strands of literature is the assumption of corporate tax avoidance being variable. Kim, McGuire, Savoy, and Wilson (2016) find that corporations converge to their optimal target level of tax avoidance by approximately 70 % over three years. This is in line with rational behavior and tradeoff theory suggesting that corporations weigh benefits and (tax as well as non-tax) costs associated with tax avoidance in making decisions about their tax planning (Scholes et al., 2016).[7] Thus, changing tax strategies and alternating levels of tax avoidance within one corporation over time appear to be highly plausible (Hoopes, Mescall, and Pittman, 2012).

Accordingly, over the past decades, a trend towards tax avoidance has emerged as ETRs of multinational as well as domestic corporations decreased continuously (Dyreng et al., 2017b). On the one hand, this may simply be due to declining statutory tax rates worldwide as a result of tax competition between countries (Devereux, Lockwood, and Redoano, 2008). On the other hand, corporations may overall engage in increased tax avoidance activities. Prior

[7] These costs of tax avoidance include, for example, financial reporting considerations and implementation costs (Shackelford and Shevlin, 2001), reputational costs (Gallemore, Maydew, and Thornock, 2014), the inability to repatriate and invest foreign earnings as well as potential political and regulatory costs (Armstrong, Blouin, Jagolinzer, and Larcker, 2015), and increased cost of capital (Cook, Moser, and Omer, 2017). Furthermore, altering the level of tax avoidance directly raises adjustment costs, such as tax advisor, foundation of new subsidiaries, restructuring of business model and ownership structure, or research and development to generate intellectual property.

literature suggests that ETRs can be influenced by changing known determinants, such as hiring a new executive officer (Dyreng, Hanlon, and Maydew, 2010).

An obvious consequence of tax avoidance is the increase in tax risk, because today's aggressiveness could negatively affect tomorrow's tax outcomes due to, for example, penalties and back taxes (Dyreng et al., 2017a; Saavedra, 2017). Generally, tax risk is the uncertainty regarding future tax payments (Blouin, 2014) and defined as the volatility of ETRs as volatility measures the dispersion of outcomes (Brealey and Myers, 1991). Evidence on the relation between tax avoidance and tax risk is mixed. Dyreng et al. (2017a) as well as Brooks et al. (2016) provide evidence of an association between low ETRs and tax risk or uncertain tax positions. Saavedra (2017) and Guenther et al. (2017), however, find that higher ETRs are associated with greater tax risk. Apparently irrespective of the level of tax avoidance, there appears to be tax risk which results in changing ETRs.

Tradeoff theory, increased tax avoidance, and tax risk suggest variable ETRs. Nevertheless, the frequently mentioned concept of tax unfairness offers a contrary view on the variability of tax avoidance. I.e., some corporations are always able to avoid taxes whereas others have hardly any chance of reaching the same low tax payments. Put differently, relative to the average level of tax avoidance some corporations appear to report always below average and others always above average. This phenomenon of heterogeneity has been puzzling researchers worldwide and is thus dubbed the undersheltering puzzle (Weisbach, 2002).

The just described persistence is well-known in other fields of research. Some studies consider temporal correlation in earnings as an indicator of accounting quality (Sloan, 1996) and Lemmon, Roberts, and Zender (2008) consider the impact of the initial capital structure on today's capital structure and find that corporations tend to keep their capital structures as initially chosen for decades. With regard to tax avoidance, there is, however, only limited

evidence on persistence. To the best of my knowledge, there are only few studies that remotely address this research question.[8]

Plesko and Weber (2009) descriptively examine time series properties of tax return data. Dyreng et al. (2008) analyze U.S. corporations over a ten-year period and examine the persistence of cash effective tax rates finding that there is some asymmetric persistence, i.e., CASH ETRs of tax aggressive corporations are more persistent than those of non-tax aggressive corporations. The main focus of their study, however, is the development of the long-run ETR measure and descriptive in nature. Therefore, the results with regard to persistence of tax avoidance are rather preliminary. Further results by Guenther et al. (2017) suggesting more persistence in the low-ETR segment as well focus on the implications for firm risk. Another study by Abdul Wahab and Holland (2015) provides some evidence for persistence of book-tax differences of UK corporations from 2005-2010. Each corporation has its own particular target level of tax avoidance (Kim et al., 2016), from which - once reached - a corporation does not want to deviate.

Taking into consideration these studies, tax avoidance appears to have a certain persistence, at least for some corporations. Aiming to raise awareness of this phenomenon through providing a more thorough examination of persistence and thereby enhancing the academic knowledge about corporate tax avoidance, I investigate the data with regard to the following hypothesis:

H1. *The level of corporate tax avoidance is persistent over time.*

Beyond the results of prior literature, it is a question of interest why some corporations exhibit a persistent level of tax avoidance. One possible explanation may be the already

[8] Some studies that investigate the influence of firm-specific determinants on tax avoidance use prior year control variables, such as size or return on assets in t_{-1} (e.g. Chen et al., 2010; Armstrong, Blouin, and Larcker, 2012; Chyz, Leung, Li, and Rui, 2013). However, these studies do not make precise inferences with regard to persistence.

mentioned costs of tax avoidance and the resulting dilatoriness in adjusting tax strategies.[9] A simple example such as some corporations employing tax optimal financial structures (Desai, Foley, and Hines, 2004; Huizinga, Laeven, and Nicodème, 2008) might clarify this argument. In order to save taxes, interest should be taxed in a low-tax jurisdiction and deducted in a high-tax jurisdiction. Thus, the corporation needs a subsidiary in a low-tax country and capital that is raised on the respective capital market. Some corporations face lower barriers than others due to their business model or structure that is already in place implying corporations that already engage in tax avoidance can more easily stay tax aggressive in subsequent years and vice versa. This implies slowly but indeed changing tax avoidance behavior. A second, more challenging and rigorous explanation is the following: I argue that an important part of firm-specific tax avoidance determinants, and thereby of the level of tax avoidance, is invariable.

This is in line with media coverage of news about tax avoidance according to which it seems to be always the same couple of corporations, such as Amazon, Apple, Google, and Starbucks, that report ETRs well below average. Academic literature also provides evidence of cross-sectional variation in tax avoidance as only some corporations benefit from tax planning (Dyreng et al., 2008; Griffith, Miller, and O'Connell, 2014; Heckemeyer and Overesch, 2017) and only multinational corporations are able to shift income and intangible assets to tax havens or low-tax countries (Hines and Rice, 1994; Dharmapala and Riedel, 2013; DeSimone, Mills, and Stomberg, 2014; Dyreng and Markle, 2016). Even policymakers advance the view that only a certain kind of corporations report lower ETRs than others. Recently, the organization for

[9] This theory could be tested by regressing a tax avoidance measure on its lagged value as it would measure the impact of a corporation's previous tax avoidance in determining future tax avoidance ($ETR_{it} = \beta_0 + \beta_1 ETR_{it-1} + \beta_2 Common\ Determinants_{it} + FE + u_{it}$). If a corporation had infinite costs of adjustment, i.e., perfectly persistent level of tax avoidance, the coefficient of interest would equal 1. Unfortunately, in a context of dynamic panel data in which the number of observations (N) is considerably larger than the number of employed time periods (T), there may be a correlation between the lagged variable and the error term (Nickell, 1981). Neither the inclusion of further observations nor further common regressors can mitigate that downward bias. Possible alternatives to slightly reduce the bias are, for example, increasing the number of time periods as the bias is of order 1/T, taking subsamples in which N is no longer larger than T (Gaibulloev, Sandler, and Sul, 2014), or employing lagged variables as instruments for the potentially biased estimator (Anderson and Hsiao, 1982). As the bias cannot yet be completely eliminated with today's knowledge, I refrain from including the analyses and leave this investigation to future research.

economic cooperation and development (OECD) has launched its action plan against BEPS (OECD, 2015) trying to suppress tax avoidance. Their main focus obviously is multinational corporations hinting at a distortion of tax avoidance opportunities. However, the ETRs of domestic corporations decrease simultaneously to those of multinationals (Dyreng et al., 2017b). Thus, other firm-specific characteristics must be influential.

A multitude of empirical studies investigates such firm-specific characteristics trying to identify the determinants of tax avoidance. The determinants include but are not limited to location of subsidiaries (Desai, Foley, and Hines, 2006; Dyreng and Lindsey, 2009), foreign activities (Rego, 2003), ownership (Chen et al., 2010), manager compensation (Armstrong et al., 2012), political costs and connections (Mills, Nutter, and Schwab, 2012; Kim and Zhang, 2016), labor unions (Chyz et al., 2013), and business models (Higgins, Omer, and Phillips, 2015). Additionally, different key figures within the financial data, such as size, leverage, or profitability, are employed to explain differences in ETRs (e.g. Gupta and Newberry, 1997; Plesko, 2003). Even though, there is this large number of work on the determinants of tax avoidance, till today, the question of why some corporations avoid more taxes than others is still puzzling.

Several issues may be causal for the unanswered problem. First, prior literature is often at odds regarding correlation of tax avoidance and common determinants. For example, the correlation of size and tax avoidance can be positive (Plesko, 2003) or negative (Chen et al., 2010). The latter also find a negative correlation for profitability whereas Rego (2003) finds a positive impact of return on assets on tax avoidance. Second, researchers who regress a measure of tax avoidance on different determinants certainly explain parts of variation in tax avoidance. Nevertheless, it is unclear how much of the overall variation is revealed. Thus, clear inferences with regard to magnitude of effects are challenging. My study, therefore, examines the actual impact of common determinants in various specifications. Third and maybe most importantly,

many empirical studies[10] moreover disregard unobserved time-invariant firm-specific characteristics. Put differently, they do not account for firm fixed effects. However, if long-term tax avoidance (Dyreng et al., 2008) is valued more than short-run fluctuations, the impact of existing, yearly changing determinants should be low compared to time-invariant factors. Furthermore, if the majority of variation in tax avoidance is determined by firm fixed effects, their influence will obviously generate a rather stable level of tax avoidance (if anything, only a small portion remains variable). This implies that the time-invariant component might explain why some corporations seemingly always avoid more taxes whereas others cannot reach those low tax payments. Consequently, firm fixed effects offer an explanation of persistent tax avoidance. I test the following hypothesis:

H2. *The level of tax avoidance is widely explained by time-invariant firm-specific characteristics (firm fixed effects).*

2.3 Sample Description

2.3.1 Data Selection

In my analyses, I apply the following sample selection criteria to test the hypotheses.[11] To maximize the coverage of this study, I impose minimal requirements on the available data. I start with all corporations covered by the database *Compustat North America* in the years from 1987 till 2015. There are a total of 31,919 firms and 357,428 firm-year observations. To increase comparability of the data, I only investigate U.S. firms. Firms outside of the U.S. face different taxing and reporting rules. Thus, non-U.S. firms and firms reporting in currencies other than U.S. Dollars are deleted. Duplicate observations are also dropped from the dataset as they distort the results.

[10] Among others Armstrong et al. (2012), Chen et al. (2010), Dyreng et al. (2017b), Dyreng and Lindsey (2009), Higgins et al. (2015), Plesko (2003), and Rego (2003) do not employ firm fixed effects in their regression.
[11] The sample development is summarized in table A1 of the appendix.

Aiming to investigate the persistence of tax avoidance, I require financial data information to calculate measures of tax avoidance. Following accounting literature, the variable of interest in this study is a corporation's ETR (e.g. Hanlon and Slemrod, 2009; Hanlon and Heitzman, 2010). As it is computed using consolidated financial statements, it shows the overall level of tax avoidance. A low ETR implies high tax avoidance as the corporation seems to pay less taxes than corporations with higher ETRs. As a broad measure, ETR captures "any form of tax reduction relative to pretax accounting income, whether through tax sheltering, location decisions, income shifting, tax preferences within the tax code, or rule changes" (Dyreng et al., 2017b, p. 442). In my main analyses, I implement the to firms most important tax avoidance measure: GAAP ETR (Graham, Hanlon, Shevlin, and Shroff, 2014), defined as tax expenses over pretax income. The latter is adjusted for special items. I require non-missing components as well as positive pretax income because negative ETRs are difficult to interpret. Furthermore, I exclude ETRs above 1 and below 0 mainly to limit the influence of outliers.[12] GAAP ETR is based on annual data and includes current and deferred taxes. It captures non-conforming tax avoidance. However, I acknowledge that it neither captures conforming tax avoidance nor deferral strategies. Therefore, inferences on the corporation's tax avoidance need to be interpreted carefully as GAAP ETR might underestimate the level of tax avoidance. Deferral strategies, for example, are included in CASH ETR. Thus, I also use CASH ETR as well as FOREIGN ETR in later robustness checks. All three measures are commonly applied in previous literature on determinants of tax avoidance. CASH ETR is calculated as income taxes paid over pretax income, FOREIGN ETR as foreign income taxes divided by foreign pretax income. Using alternative tax avoidance measures changes my sample size as all data requirements are then based on the alternative measure.[13]

[12] Furthermore, by excluding values above 1 and below 0, I implicitly control for a potential bias due to one-time reconciliation issues as a result of abnormal activities including business dispositions (Phillips, 2003; Abdul Wahab and Holland, 2015). The exclusion of firm-year data with negative pretax income (leading to negative ETRs) enhances interpretation of the effective tax rate measure (Dyreng et al., 2008).

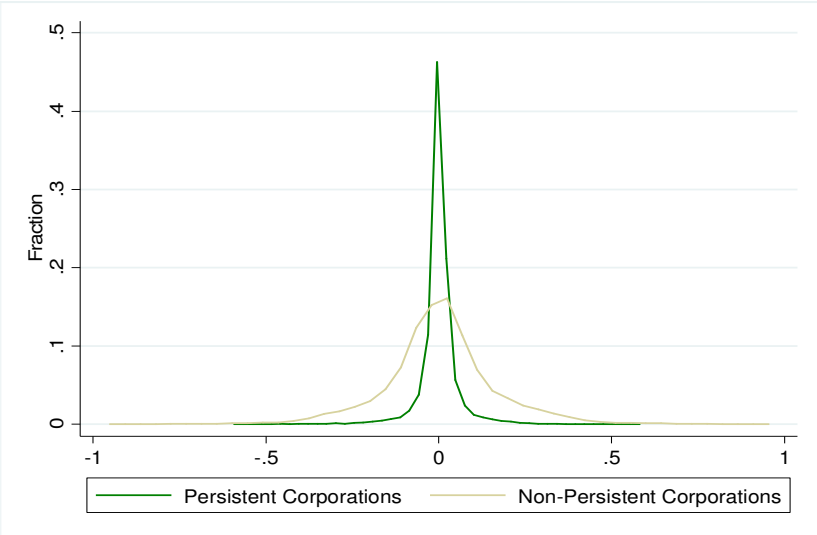
[13] Table A2 of the appendix presents the distribution of those two alternative tax avoidance measures.

However, for my main analyses, I want to keep the sample size and composition constant. Thus, I delete firm-year observations, in which any of my control variables is missing (see table A3 of the appendix for a list of controls and their definition). Furthermore, I require each observation in my sample to have an available GAAP ETR in the prior year. Only by doing so, I can investigate persistence. I identify persistence in tax avoidance in my sample by defining PERSCORP as corporations whose ETR is in the same quartile as in the previous year. Quartiles are formed based on a year average ETR. Using this definition, I capture the persistence of a corporate's tax avoidance level relative to the average tax avoidance level of the U.S. market. I obtain data for 9,054 firms with 65,939 firm-year observations that can be used for my analyses. Please note that the first year in my sample is 1988 due to the last requirement.

2.3.2 Explorative Investigation of the Sample

In this section, I investigate the selected sample with regard to my two hypotheses. Table 1 presents some descriptive statistics. Panel A shows the distribution of GAAP ETR for all firms as well as for persistent corporations. The mean GAAP ETR amounts to 31.8 % and for persistent corporations to 30.7 %.

Figure 1. Distribution of DEV ETR



Notes: Figure 1 presents the distribution of DEV ETR. It differentiates between persistent and non-persistent corporations according to the definition of PERSCORP. The x-axis shows the values of DEV ETR. The y-axis represents the respective fraction. Variables are defined in table A3 of the appendix.

Table 1. Descriptive Statistics

Panel A: Distribution of effective tax rates						
	# of observations	Mean	Std. dev.	25th Percentile	Median	75th Percentile
All Firms						
GAAP ETR	65,939	0.3179	0.1291	0.2709	0.3484	0.3860
DEV ETR	65,939	0.0023	0.1222	-0.0301	0.0005	0.0325
Persistent Corporations						
GAAP ETR	36,065	0.3073	0.1409	0.2564	0.3480	0.3880
DEV ETR	36,065	0.0012	0.0627	-0.0127	0.0004	0.0145

Panel B: Common determinants of effective tax rates	All Firms			Persistent Corporations		
	# of observations	Mean	Std. dev.	# of observations	Mean	Std. dev.
SIZE	65,939	6.0417	2.1455	36,065	6.0199	2.1815
SALES	65,939	5.9861	2.0378	36,065	5.9544	2.0793
RD	65,939	0.0222	0.0490	36,065	0.0217	0.0484
LEV	65,939	0.2298	0.1914	36,065	0.2271	0.1936
CAPINT	65,939	0.3293	0.2574	36,065	0.3371	0.2646
INTANG	65,939	0.1136	0.1671	36,065	0.1087	0.1644
CAPEX	65,939	0.2475	0.1805	36,065	0.2478	0.1815
ADVEX	65,939	0.0090	0.0228	36,065	0.0090	0.0229
ROA	65,939	0.1012	0.0797	36,065	0.1086	0.0824
NOL	65,939	0.1555	0.3624	36,065	0.1540	0.3609
MNE	65,939	0.3058	0.4607	36,065	0.2915	0.4545
GROWTH	65,939	0.1571	0.3066	36,065	0.1558	0.2917

Notes: Table 1 shows descriptive statistics. Panel A presents the distribution of effective tax rates. It shows the values for the yearly ETR as well as the difference in ETRs relative to the average to reflect possible persistence of ETRs. Panel B shows the values for control variables. Variables are defined in table A3 of the appendix.

However, more interesting for the purpose of this paper are the values of DEV ETR. To calculate DEV ETR, I first subtract the year average ETR from GAAP ETR to get the RELATIVE ETR for each observation. This computation is similar to the known statistical concept of variance. In a second step, however, I subtract prior year's RELATIVE ETR from the current RELATIVE ETR. Therefore, DEV ETR reflects the change in GAAP ETR compared to the average. As table 1 shows DEV ETR is close to 0 (0.0023) for all firms hinting at general persistence. As expected, the value averages even lower for persistent corporations, namely, with 0.0012, at only half of the overall value. Taking a look at the percentiles, DEV

ETR is always smaller for persistent corporations. With regard to hypothesis H1, the shown values imply a certain persistence of tax avoidance. Accordingly, figure 1 shows the distribution of DEV ETR for persistent as well as non-persistent corporations revealing that, quite obviously, the values of DEV ETR are closer to 0 for persistent corporations. These results imply that the group of persistent corporations really reports ETRs that do not change as much as those of non-persistent corporations.

Panel B of table 1 presents descriptive statistics for firm characteristics that prior literature commonly applies as possible determinants of ETRs. As persistent corporations exhibit no obvious difference to the overall sample, it has to be assumed that common characteristics alone do not explain why corporate tax avoidance seems to be persistent for some corporations.

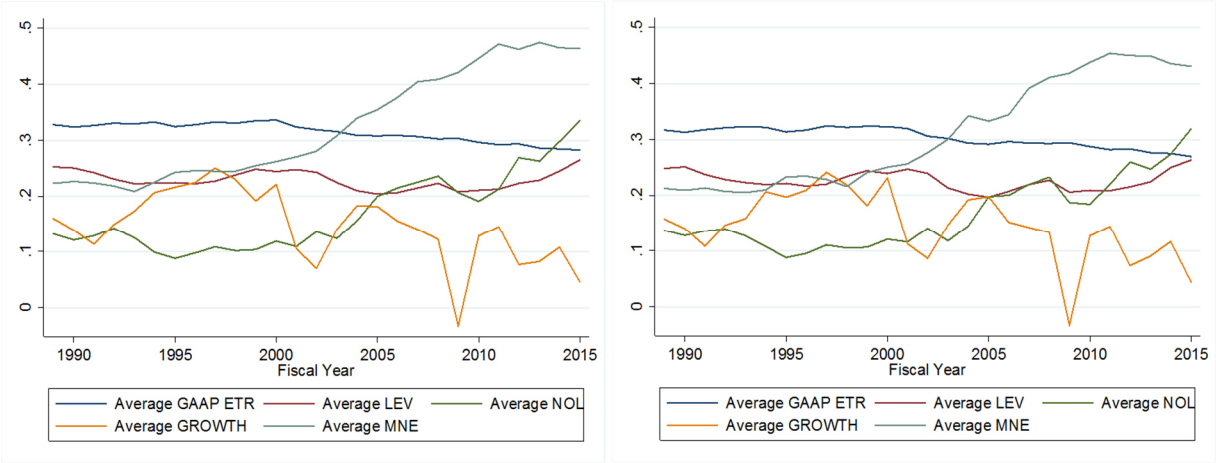
Table 2. Industries

	All Firms		Persistent Corporations (PERSCORP)	
	# of firms	% of firms	# of firms	% of firms
Food	282	3.11 %	152	3.02 %
Mines	94	1.04 %	55	1.09 %
Oil	425	4.69 %	249	4.96 %
Clothes	189	2.09 %	107	2.13 %
Durables	263	2.90 %	137	2.73 %
Chemicals	167	1.84 %	94	1.87 %
Consumer	248	2.74 %	130	2.59 %
Construction	360	3.98 %	186	3.70 %
Steel	129	1.42 %	70	1.39 %
Fabricated Products	88	0.97 %	43	0.86 %
Machinery	1,192	13.17 %	630	12.54 %
Cars	129	1.42 %	65	1.29 %
Transportation	346	3.82 %	189	3.76 %
Utilities	443	4.89 %	266	5.29 %
Retail	648	7.16 %	378	7.52 %
Financial	600	6.63 %	354	7.04 %
Other	3,451	38.12 %	1,920	38.21 %
	9,054	100.00 %	5,025	100.00 %

Notes: Table 2 presents the industry distribution. I use the 17 industry classification according to Fama and French. Additionally, the table shows how many persistent corporations operate in which industry. Variables are defined in table A3 of the appendix.

Table 2 presents further information for my sample regarding industries of the included corporations. Considering 17 different industries[14] also leads to no apparent differences between the overall sample and persistent corporations. Thus at first sight, industry classification seems not to be the driving determinant with regard to persistence of tax avoidance, either.

Figure 2. Average ETR and Determinants over Time



Notes: Figure 2 shows the yearly average values of selected financial statement data over my sample period for the full sample on the left-hand side and persistent corporations only on the right-hand side. Both graphs include the values of LEV, NOL, GROWTH, and MNE as potential determinants of tax avoidance. Corporate tax avoidance is plotted by GAAP ETR. Variables are defined in table A3 of the appendix.

Nevertheless, previous literature generally applies this set of determinants calculated from financial statement data as they are supposed to explain corporate tax avoidance. However, figure 2 implies that those simple OLS regressions of ETRs – the most used measure of tax avoidance – are likely to be misspecified. The diagram depicts average values of GAAP ETR for the full sample as well as for persistent corporations only over time. The lines of GAAP ETR are practically horizontal. This signifies hardly any change in the level of corporate tax avoidance. I acknowledge that this only depicts the average and variation is possible. Yet, common determinants, compared to my measure of tax avoidance, experience huge in- and declines over the same time period. Consider this: if GROWTH of 10 % (0.1) leads to an ETR

[14] The industry classification is based on the 17 different industries from Fama and French. Updated industry classification can be downloaded from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/changes_ind.html.

of roughly 0.3 in one year, why should next year's ETR of again 0.3 be explained by GROWTH of 0.2? Even leverage (red line), which appears to be relatively constant, varies a lot more than GAAP ETR does. Thus, their explanatory power with regard to the level of tax avoidance becomes questionable. It appears to be likely that there is something unobservable and highly time-invariant which explains the level of tax avoidance. This suggests a first support for my hypothesis H2, with which I aim to enhance academic knowledge with regard to this question of (non-) variation of tax avoidance.

2.4 Analyses and Discussion of Results

2.4.1 Raising further Awareness of Persistence of Tax Avoidance

Following the developed hypothesis H1, I aim to make clear to academics and policymakers that the level of corporate tax avoidance is persistent over time. Some corporations are always able to avoid more taxes relative to the average level of tax avoidance whereas others never reach the same low tax payments. Considering the data, I get a first hint of support for this hypothesis by performing a non-parametric variance decomposition of tax avoidance. More precisely, I calculate the within- and between-firm variation of GAAP ETR. The estimates are 9.1 % and 13.0 %, respectively, for the whole sample. Thus, the between-firm variation is roughly 40 % larger than the within-firm variation. Intuitively, this suggests that the level of tax avoidance varies more across firms than within firms over time. This is consistent with hypothesis H1. Limiting the computation to persistent corporations only, the estimates are 7.3 % and 14.8 %, respectively. In this case, the between-firm variation is even twice as large as the within-firm variation. A within-firm variation of 0 would imply perfect persistence of tax avoidance.

To further examine the indicated persistence of tax avoidance, I take a closer look at the definition of PERSCORP. I calculate the probability that a firm that is in a certain ETR quartile in one year will remain in the same quartile in the subsequent period. Quartiles are formed

based on the yearly average GAAP ETR. Table 3 presents the probabilities of reporting in one GAAP ETR quartile based on the previous GAAP ETR quartile. The diagonal serves as a measure of persistence as it shows the probability of remaining in the same quartile. The first row/column presents corporations that reported tax aggressive ETRs (lowest quartile of the distribution, i.e., lots of tax avoidance), whereas the fourth row/column represents the highest quartile of the distribution, i.e., high ETRs and hardly any tax avoidance. The highest probabilities can be found on the diagonals for all specifications. This again suggests support for hypothesis H1, i.e., persistence of tax avoidance. Across all quartiles, the probability of remaining in the same quartile is above 50 %, e.g. a likelihood of 59.5 % of staying in the lowest quartile of the distribution. A likelihood of 25 % implies the absence of persistence whereas a likelihood of 100 % implies perfect persistence.

Table 3. Probability of Reporting in the Same Quartile

PRIOR QUARTILE	(Current) QUARTILE 1	2	3	4	Total
1	**59.49 %**	21.79 %	8.99 %	9.73 %	100.00 %
2	15.69 %	**51.54 %**	21.87 %	10.89 %	100.00 %
3	6.36 %	21.16 %	**51.90 %**	20.58 %	100.00 %
4	7.12 %	12.43 %	23.38 %	**57.08 %**	100.00 %
Total	20.12 %	27.13 %	27.83 %	24.91 %	100.00 %

Notes: Table 3 presents for GAAP ETR probabilities of remaining in the same QUARTILE. It considers the ETR quartile of the previous reporting year. The first quartile always represents the lowest ETRs of the distribution. The diagonal serves as an indicator of persistent tax avoidance. Variables are defined in table A3 of the appendix.

Table 3 basically represents my previously employed definition of PERSCORP. However, the amount of persistent corporations obviously depends on the definition. Thus, to strengthen my findings I consider two alternative definitions of persistent corporations focusing on the limitations of my previous analysis.[15] As a first alternative, I consider firms as persistent if the change in RELATIVE ETR is smaller than 5 %. Previously, corporations that are right at

[15] Of course, it is possible to apply even further definitions, such as quintiles or deciles instead of quartiles, always in the same quartile, or the volatility of ETR. VOLATILITY is a well-established measure of tax risk, which I consider in an additional analysis in section 2.4.3. However, I do not think that it would be helpful to show umlimited definitions of PERSCORP as the exact magnitude of persistence still remains a matter of definition. The ones I provided should already confirm that persistence is present to a certain extent.

the border of one quartile would not be captured by PERSCORP if even a slight change put them in the next quartile of the ETR distribution. This problem is avoided by directly taking the magnitude of the change into account. Second, I define persistent corporations as those corporations that always or never report below the yearly average. Always/never implies that all firm-year observations meet the criteria. Consequently, the definition captures long-term instead of the previous short-term persistence. A graphical representation can be found in figure A1 of the appendix. 15.2 % of the firms in my sample never report below average and 8.4 % of the sample always report below average. The dummy variable PERSCORP is consequently set to 1 for those corporations in all firm-year observations.

Table 4. Differences in DEV ETR using Various Definitions of PERSCORP

Panel A: GAAP ETR			
	N	Difference	Std. err.
Same Quartile as Before	65,939	0.0863***	0.0007
Change smaller than 0.05	65,939	0.0761***	0.0012
Always Above/Below Average	65,939	0.0216***	0.0009
Panel B: CASH ETR			
	N	Difference	Std. err.
Same Quartile as Before	58,700	0.1421***	0.0010
Change smaller than 0.05	58,700	0.1320***	0.0022
Always Above/Below Average	58,700	0.0457***	0.0015
Panel C: FOREIGN ETR			
	N	Difference	Std. err.
Same Quartile as Before	19,905	0.1264***	0.0017
Change smaller than 0.05	19,905	0.1186***	0.0035
Always Above/Below Average	19,905	0.0271***	0.0023

Notes: Table 4 presents the results of two-sample t-tests, which estimate the difference in DEV ETR between persistent and non-persistent corporations. I compute the difference for alternative definitions of PERSCORP. Panel A considers the main sample using GAAP ETR whereas panel B and C consider the CASH ETR sample and the FOREIGN ETR sample, respectively. Variables are defined in table A3 of the appendix. *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

To statistically show that some corporations exhibit persistent levels of tax avoidance regardless of the definition, I estimate a two-sample t-test, in which I compare DEV ETR of persistent and non-persistent corporations. Panel A of table 4 presents the results using the three alternative definitions. Panel B and C employ alternative tax avoidance measures as robustness

checks. Consistently positive and highly significant differences between the two groups signify that persistent corporations exhibit lower changes in ETR compared to the yearly average. More precisely, other corporations deviate, on average, more from their prior RELATIVE ETR than persistent corporations. This suggests support for my hypothesis H1 as at least a certain group of corporations achieves a level of tax avoidance that appears to be persistent over time.

Even though I cannot precisely determine the magnitude of persistence and certainly many corporations are not persistent, the overall implication offers – at least partly – support for hypothesis H1, which states that tax avoidance is persistent over time. This circumstance can no longer be neglected and should be further investigated. With my subsequent analyses of hypothesis H2, I aim to provide a more thorough understanding of persistence by trying to explain the reason behind persistent tax avoidance.

2.4.2 Identifying the Reason behind Persistent Tax Avoidance

In figure 2 (cf. section 2.3), I considered the average values of GAAP ETR as well as of selected common determinants. The implication of that figure is both troubling and interesting. First, it is troubling because it suggests that traditional control variables do not appear to account for much of the corporate tax avoidance level. Second, it is interesting because it suggests that an important factor is missing from existing specifications. This factor must contain a significant time-invariant component. The presence of this mostly unobserved determinant of tax avoidance suggests that previous parameter estimates may be deteriorated by omitted variable bias (Arellano, 2003; Hsiao, 2003). To investigate the importance of this time-invariant factor, I use two different sets of tests.

As a first analysis, I present the results of estimating corporate tax avoidance regressions using a simple OLS approach that ignores most firm-specific effects as well as the results of a more refined approach in which firm fixed effects are included. Before I include firm fixed effects, I already account for some time-invariant firm-specific effects by including industry fixed effects as those are often applied in previous studies. Thereby, I can rule out that the time-

invariant component is completely captured by a firm's industry. I estimate several variations, as specified in table 5, of equation (1).

$$Tax\ Avoidance\ Measure_{it} = \beta_0 + \beta_1\ Common\ Determinants_{it} + FE + u_{it} \quad (1)$$

As tax avoidance measure, I mostly use GAAP ETR. However, as robustness checks I also employ CASH ETR and FOREIGN ETR. Furthermore, to concentrate on the level of tax avoidance more abstractly, I use QUARTILE in some specifications instead of the continuous ETR measures. Common determinants are the set of variables explained in table A3 of the appendix. Most prior literature on tax avoidance employs those determinants, a subset thereof or similar variables, as control variables. Using the same variables basically replicates the results of previous studies. This feature enables me to directly compare those results with my fixed effects regression. FE are fixed effects. In all my regressions, I consider year fixed effects. Depending on the specification, I either add industry fixed effects or firm fixed effects. The latter completely eliminates all time-invariant heterogeneity between firms and thus, perfectly captures the missing time-invariant factor.

The results in specification (1) and (2) of table 5 illustrate that most common determinants are highly statistically significant, regardless of the model specification. Yet, leverage, intangibles, and capital expenditures lose their significance. This suggests that their impact on tax avoidance is captured by firm fixed effects implying that these determinants are rather stable over time as well. Column (3) shows the sensitivity of estimated magnitudes to the specification. It presents by how many percent the point estimator changes if I add firm fixed effects instead of industry fixed effects. Some determinants gain impact whereas others exhibit declining estimators. On average, the change consists of an increase by 37.6 %. Column (6) considers the regressions with QUARTILE as dependent variable. The results are comparable as the change amounts to 54.5 % and again intangibles as well as capital expenditures lose their

significance. It becomes apparent that the inclusion of firm fixed effects changes coefficients and thus, the results of common analyses.

Table 5. Parameter Sensitivities to Firm Fixed Effects

Variables	GAAP ETR		Change	QUARTILE		Change
	1	2	3	4	5	6
SIZE	-0.0052**	0.0227***	536.5 %	-0.1090***	0.1360***	224.8 %
	(0.0022)	(0.0032)		(0.0158)	(0.0265)	
SALES	0.0109***	-0.0084***	-177.1 %	0.1280***	-0.0637**	-149.8 %
	(0.0022)	(0.0032)		(0.0161)	(0.0268)	
RD	-0.3780***	-0.1420***	-62.4 %	-3.839***	-1.1900***	-69.0 %
	(0.0220)	(0.0506)		(0.1720)	(0.3890)	
LEV	-0.0227***	-0.0063	-72.2 %	-0.0059	0.0389	759.3 %
	(0.0067)	(0.0074)		(0.0495)	(0.0595)	
CAPINT	-0.0128*	0.0197*	253.9 %	-0.1000*	0.2370***	337.0 %
	(0.0070)	(0.0106)		(0.0532)	(0.0872)	
INTANG	0.0374***	-0.0055	-114.7 %	0.3170***	0.0193	-93.9 %
	(0.0071)	(0.0096)		(0.0578)	(0.0817)	
CAPEX	0.0262***	-0.0024	-109.2 %	0.2330***	-0.0310	-113.3 %
	(0.0058)	(0.0048)		(0.0439)	(0.0389)	
ADVEX	-0.0486	0.0493	201.4 %	-0.5060	0.3480	-168.8 %
	(0.0381)	(0.0628)		(0.3480)	(0.5690)	
ROA	0.1910***	0.3340***	74.9 %	1.9710***	3.3290***	68.9 %
	(0.0164)	(0.0151)		(0.1200)	(0.1160)	
NOL	-0.0208***	-0.0127***	-38.9 %	-0.1730***	-0.1210***	-30.1 %
	(0.0021)	(0.0020)		(0.0164)	(0.0155)	
GROWTH	-0.0112***	-0.0054**	-51.8 %	-0.0654***	-0.0235	-64.1 %
	(0.0023)	(0.0023)		(0.0179)	(0.0196)	
MNE	-0.0067***	-0.0074***	10.4 %	-0.2030***	-0.1080***	-46.8 %
	(0.0022)	(0.0025)		(0.0186)	(0.0211)	
Year FE	✓	✓		✓	✓	
Industry FE	✓			✓		
Firm FE		✓			✓	
N	65,939	65,939		65,939	65,939	
Adj. R^2	0.077	0.456		0.095	0.414	

Notes: Table 5 shows the results of OLS regressions with GAAP ETR and QUARTILE as dependent variables. For each measure of tax avoidance, different sets of parameter estimates are presented to show the additional impact of including firm fixed effects (Firm FE). Year FE is year fixed effects and Industry FE is industry fixed effects. Also shown is the percent change in the magnitude of the coefficient when implementing Firm FE instead of Industry FE. The constant is not reported. Robust standard errors clustered by firms are shown in parentheses. Variables are defined in table A3 of the appendix. *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

Robustness checks are presented in table A4 to A6 of the appendix. In table A4, I use CASH ETR and FOREIGN ETR as dependent variables. Even though estimates change,

inferences remain basically constant. In table A5 and A6, I consider only persistent corporations using alternative definitions of PERSCORP. Inferences are similar to the full sample. However, the impact of the unobservable time-invariant component is even more striking (cf. the columns regarding GAAP ETR of table A5). Most coefficients actually decline in magnitude moving to the firm fixed effects regression. On average, the decline consists of 81.1 %. Solely SIZE, ROA, and MNE exhibit increasing magnitudes.

It can be concluded that irrespective of the specification, the inclusion of firm fixed effects generally leads to changes in influence of other determinants (either through loss of significance or alternating magnitudes). Furthermore, the explanatory power (adjusted R-squared) of the regression increases. These effects are due to capturing previously unobserved time-invariant components and removing the between variation, only some of which is also captured by common determinants. Nonetheless, it is still unclear precisely how important this firm-specific effect is.

As a second test, I turn to a parametric variance decomposition of tax avoidance, which allows me to identify how much of the variation is attributable to which determinant. I do so by estimating modifications of equation (1) in an analysis of covariance (ANCOVA). Table 6 presents the results. Each column represents a different model specification for level of tax avoidance measured by GAAP ETR. Following the research design of Lemmon et al. (2008), the shown values correspond to the fraction of the total Type III partial sum of squares for a certain specification. That is, I divide the partial sum of squares for each parameter by the total partial sum of squares across all parameters. Thereby, I force the columns to sum to 100 %. For example, if I only insert firm fixed effects into the estimation, 100 % of the explained variation is attributable to them.

Firm fixed effects alone result in an adjusted R-squared of 0.918 (specification (1)), that is they capture 92 % of the variation in GAAP ETR. Neither the combination of year and industry fixed effects (specification (2)) nor the additional inclusion of common determinants

(specification (5)) can reach the same explanatory power. Despite the impact of firm fixed effects, it should be noted that common determinants alone exhibit an adjusted R-squared of 0.833 (specification (4)). E.g. profitability (ROA) appears to be quite an important determinant whereas ADVEX has basically no impact. However, if firm fixed effects are included almost all variation is attributable to them, i.e., 96 % in specification (6). Thus, firm fixed effects also capture the variation previously explained by common determinants. Robustness tests in table A7 of the appendix with CASH ETR and FOREIGN ETR as alternative tax avoidance measures confirm this implication.

Table 6. Parametric Variance Decompositions

Variables	GAAP ETR					
	1	2	3	4	5	6
Firm FE	100.0 %	.	99.9 %	.	.	96.3 %
Year FE	.	94.3 %	0.1 %	.	67.9 %	0.1 %
Industry FE	.	5.7 %	.	.	6.7 %	.
SIZE	.	.	.	1.3 %	1.0 %	0.1 %
SALES	.	.	.	12.5 %	1.9 %	0.1 %
RD	.	.	.	0.2 %	9.8 %	0.1 %
LEV	.	.	.	5.6 %	0.1 %	0.0 %
CAPINT	.	.	.	14.0 %	0.1 %	0.0 %
INTANG	.	.	.	2.7 %	0.0 %	0.0 %
CAPEX	.	.	.	29.2 %	0.8 %	0.0 %
ADVEX	.	.	.	0.0 %	0.0 %	0.0 %
ROA	.	.	.	32.5 %	7.0 %	2.9 %
NOL	.	.	.	0.2 %	4.1 %	0.3 %
GROWTH	.	.	.	0.0 %	0.1 %	0.0 %
MNE	.	.	.	1.8 %	0.5 %	0.1 %
Adj. R^2	0.918	0.860	0.918	0.833	0.867	0.922

Notes: Table 6 presents a variance decomposition for various model specifications with GAAP ETR as dependent variable. Adjusted R-squares are shown at the bottom. I compute the Type III partial sum of squares for each parameter in the model and then normalize each estimate by the sum across all parameters. This way, I force each column to sum to 100 %. For example, in specification (4), 1.3 % of the explained variation captured by the included determinants can be attributed to SIZE. FE are fixed effects. Variables are defined in table A3 of the appendix.

Applying the results of the two different kinds of tests applied in this section on my hypothesis H2, I find strong support suggesting that the level of tax avoidance is widely determined by a time-invariant effect. Thus, corporations exhibit various firm-specific characteristics that are (close to) time-invariant. Consequently, they remain constant over time

and as they have a highly significant influence on the level of corporate tax avoidance, the level of corporate tax avoidance remains constant as well.

Table 7. Parametric Variance Decompositions with Detailed Industries

GAAP ETR	49 Industries			SIC Codes		
	1	2	3	4	5	6
Firm FE	.	.	94.0 %	.	.	88.5 %
Industry FE	28.7 %	18.4 %	1.5 %	92.0 %	72.6 %	6.6 %
Year FE	71.3 %	54.0 %	1.0 %	8.0 %	6.1 %	1.1 %
SIZE	.	1.9 %	0.3 %	.	0.0 %	0.3 %
SALES	.	2.6 %	0.0 %	.	0.1 %	0.0 %
RD	.	5.1 %	0.0 %	.	3.7 %	0.0 %
LEV	.	0.3 %	0.0 %	.	0.1 %	0.0 %
CAPINT	.	0.0 %	0.0 %	.	0.3 %	0.0 %
INTANG	.	0.1 %	0.0 %	.	0.0 %	0.0 %
CAPEX	.	0.8 %	0.0 %	.	0.4 %	0.0 %
ADVEX	.	0.1 %	0.0 %	.	0.1 %	0.0 %
ROA	.	10.7 %	2.9 %	.	11.6 %	3.1 %
NOL	.	5.5 %	0.2 %	.	4.9 %	0.2 %
GROWTH	.	0.1 %	0.0 %	.	0.0 %	0.0 %
MNE	.	0.3 %	0.1 %	.	0.2 %	0.1 %
Adj. R^2	0.863	0.868	0.923	0.872	0.876	0.923

Notes: Table 7 presents a variance decomposition for various model specifications with GAAP ETR as dependent variable to examine the influence of a corporation's industry. In specifications (1) to (3), I employ the Fama and French 49 different industries classification. Specifications (4) to (6) consider directly the reported SIC codes. Adjusted R-squares are shown at the bottom. I compute the Type III partial sum of squares for each parameter in the model and then normalize each estimate by the sum across all parameters. This way, I force each column to sum to 100 %. For example, in specification (2), 1.9 % of the explained variation captured by the included determinants can be attributed to SIZE. FE are fixed effects. Variables are defined in table A3 of the appendix.

Having identified the significant impact of an unobserved component, the next logical empirical task consists of further defining this time-invariant firm-specific effect. One possible aspect that hardly changes is the business model proxied by the industry of a corporation. It is quite interesting, however, that industry fixed effects appear to capture only a fraction of what firm fixed effects do. In specification (5) of table 6, only 6.7 % of the explained variation are attributable to industry fixed effects. This would imply that the business model alone does not explain tax avoidance and that other aspects are influential. Considering a slightly more narrow industry classification, i.e., 49 instead of 17 different industries, as shown in specification (1) to (3) of table 7 is consistent with this inference. Applying a very detailed industry classification (SIC codes), which is supposed to better capture the differences in business models, increases

the impact of industry fixed effects. Thus, industry / the business model is certainly one aspect of the time-invariant component but as firm fixed effects (specification (6)) capture yet more of the variation, more research needs to be done to identify unobserved aspects. I suggest researchers focus on exogenous shocks that reveal until then unknown effects to move academic knowledge forward.

2.4.3 Additional Tests Regarding Persistence of Tax Avoidance

Persistent Corporations and Tax Risk

In this section, I examine the influence of persistent tax avoidance on tax risk, two closely related concepts. For several reasons, tax avoidance may lead to higher uncertainty regarding future tax payments (Blouin, 2014). Nevertheless, shareholders want their corporations to take appropriate risks (Rego and Wilson, 2012) meaning that corporations should reduce their tax payments to optimize the profit. Prior studies provide evidence of an association between low ETRs and tax risk or uncertain tax positions (Dyreng et al., 2017a; Brooks et al., 2016). Guenther et al. (2017), however, find that higher ETRs are associated with greater tax risk. With my analysis, I aim to show that this mixed evidence may be partly due to persistence of tax avoidance.

Table 8. Distribution of VOLATILITY

	# of observations	Mean	Std. dev.	25th Percentile	Median	75th Percentile
All Firms	35,971	0.0955	0.0828	0.0374	0.0718	0.1273
Persistent Corporations						
Same Quartile	16,754	0.0659	0.0682	0.0221	0.0448	0.0834
Always > / < Avg.	4,157	0.0483	0.0533	0.0108	0.0345	0.0674
Change < 0.05	2,107	0.0360	0.0559	0.0030	0.0143	0.0448

Notes: Table 8 presents descriptive statistics of VOLATILITY as tax risk measure. Tax risk is defined as the three-year CASH ETR volatility. Values are presented for the full sample conditional on data availability as well as for persistent corporations. I differentiate between the different definitions of PERSCORP. Variables are defined in table A3 of the appendix.

Tax risk is generally defined as the volatility of ETRs as volatility measures the dispersion of outcomes and thus, depicts the involved uncertainty (Brealey and Myers, 1991).

Following prior literature, I use the standard deviation of annual CASH ETRs over three years. The measure captures the volatility of income taxes or tax payments relative to pretax income and thus, measures the uncertainty of a corporation's ETR.[16] Table 8 indicates that tax risk is especially low for persistent corporations. Due to the nature of tax risk's definition, the result is little surprising. Nevertheless, persistent corporations impact the overall measured tax risk. To clarify this implication empirically, I regress the indicator of persistent corporations PERSCORP on tax risk, as presented in equation (2). Its coefficient indicates how tax risk of those corporations reacts in relation to corporations with less persistent levels of tax avoidance. I expect significantly negative point estimators as they indicate a reduction in tax risk.

$$Volatility_{it} = \beta_0 + \beta_1\, PERSCORP_{it} + \beta_2\, Common\ Determinants_{it} + FE + u_{it} \quad (2)$$

Table 9. Tax Risk Analyses

Dependent Variable: VOLATILITY	Same Quartile as Before			Change < 0.05
	1	2	3	4
PERSCORP	-0.0373***	-0.0372***	-0.0331***	-0.0324***
	(0.0009)	(0.0009)	(0.0015)	(0.0019)
Controls	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
N	35,971	34,386	12,559	35,971
Adj. R^2	0.397	0.391	0.380	0.358

Notes: Table 9 presents the results of the tax risk analyses. It shows the impact of PERSCORP on tax risk measured as three-year CASH ETR volatility. Specification (1) shows the results of the main regression. Specifications (2) and (3) consider subsamples: non-financials and multinationals only, respectively. In specification (4), I apply an alternative definition of PERSCORP as specified. Controls include common determinants as applied in previous analyses and listed in the appendix. FE are fixed effects. The constant is not reported. Robust standard errors clustered by firms are shown in parentheses. All variables are defined in table A3 of the appendix. *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

Table 9 presents the results of the regression. In specification (1), the point estimate for PERSCORP is negative and significant implying that persistent tax avoidance reduces tax risk. Robustness checks, in which I limit the analyses to subsamples of non-financials or

[16] Some studies rely on unrecognized tax benefits (UTBs) to measure tax risk (e.g. Dyreng et al., 2017a). However, it is not clear whether UTBs can be used interchangeably to tax rate volatility as future payments associated with UTBs are predictable (Ciconte, Donohoe, Lisowsky, and Mayberry, 2016). Thus, it does not clearly capture the intention of tax risk. Guenther et al. (2017) find no strong relation of UTBs and future tax rate volatility. For these reasons, I do not employ UTBs.

multinationals only, confirm the result. Also applying an alternative definition of PERSCORP is in line with the result in specification (1). The previously applied long-term definition of reporting always above or below average cannot be used as the coefficient is omitted due to the inclusion of firm fixed effects. Overall, the results show that persistent corporations exhibit lower tax risk. Taking that into account might be a first step to generate clearer results with regard to tax risk and tax avoidance.

Worldwide Persistence

In the following additional analysis, I aim to provide first evidence on whether persistence of tax avoidance is a U.S. phenomenon or whether it can be found worldwide. If persistence is present globally, the importance of this paper's implications is even more striking. To examine corporations worldwide, I use the database *Compustat Global* covering more than 100 countries. Keeping all other data requirements constant, I receive a global sample in which I can identify persistent corporations based on their level of tax avoidance.

Looking at the descriptive statistics for this sample as presented in table 10 it becomes clear that persistent corporations exhibit lower changes in GAAP ETR compared to the average even in the global context. That is, DEV ETR of persistent corporations is, on average, 5 percentage points lower than of non-persistent corporations.

Table 10. Distribution of Global Effective Tax Rates

	# of observations	Mean	Std. dev.	25th Percentile	Median	75th Percentile
All Firms						
GAAP ETR	212,898	0.2786	0.1629	0.1640	0.2671	0.3642
DEV ETR	212,898	0.0086	0.1371	-0.0360	0.0052	0.0500
Persistent Corporations						
GAAP ETR	126,926	0.2763	0.1729	0.1500	0.2669	0.3776
DEV ETR	126,926	0.0034	0.0752	-0.0196	0.0033	0.0259

Notes: Table 10 presents descriptive statistics of GAAP ETR for the global sample, i.e., corporations covered by the database *Compustat Global*. Values are presented for the full sample conditional on data availability as well as for persistent corporations. Variables are defined in table A3 of the appendix.

Repeating further steps of the previous analyses also leads to the conclusion that there is a certain worldwide persistence. For example, the diagonal of table 11 shows values between 52.4 % and 68.6 % implying that more than half of the worldwide corporations report the same level of tax avoidance as before. Consequently, the results of this paper may affect academic researchers and policymakers all over the world. However, it should be noted that a more careful examination of each country on its own is necessary to draw precise inferences.

Table 11. Probability of Reporting in the Same Quartile in the Global Context

PRIOR QUARTILE	(Current) QUARTILE 1	2	3	4	Total
1	**64.03 %**	22.92 %	7.62 %	5.43 %	100.00 %
2	16.87 %	**52.36 %**	22.34 %	8.43 %	100.00 %
3	5.37 %	18.70 %	**54.71 %**	21.21 %	100.00 %
4	4.17 %	7.33 %	19.88 %	**68.61 %**	100.00 %
Total	22.17 %	25.84 %	26.69 %	25.30 %	100.00 %

Notes: For the global sample, table 11 presents for GAAP ETR probabilities of remaining in the same QUARTILE. It considers the ETR quartile of the previous reporting year. The first quartile always represents the lowest ETRs of the distribution. The diagonal serves as an indicator of persistent tax avoidance. Variables are defined in table A3 of the appendix.

2.5 Conclusion

Many researchers so far have attempted to solve the undersheltering puzzle. However, to the best of my knowledge, the time-invariant component – until today – has been mostly neglected. Adding this dimension to common analyses, I find a certain persistence of the undersheltering puzzle. For various definitions, I find that some corporations tend to report the same level of tax avoidance as before. This finding is in line with the general belief of tax unfairness and that always the same couple of corporations are able to avoid taxes, but contradicts the commonly applied assumption of tax avoidance being completely variable. Even though perfect persistence does not exist, this aspect of tax avoidance is worth to be investigated as it affects future analyses.

Well-known determinants of tax avoidance seem to not explain the difference between persistent and non-persistent corporations. Thus, I perform further analyses to identify the

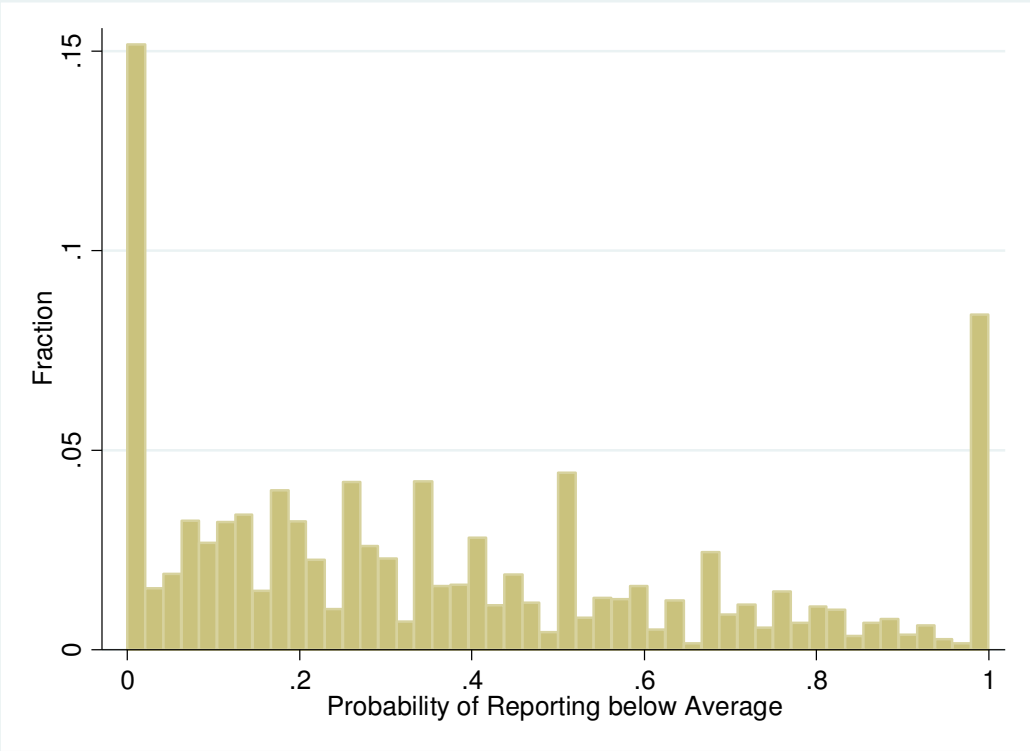
reason of persistence.[17] I investigate the influence of unobserved time-invariant firm-specific characteristics, i.e., firm fixed effects. Including them leads to higher explanatory power of the regression by simultaneously changing or even reducing the influence of common determinants. This implies a very high impact of firm fixed effects on persistence of tax avoidance. Including this factor in an analysis of covariance (as executed in table 6) reveals that over 96 % of the explained variation can be attributed to them.

Obviously, a limitation of this paper is that the results depend on the definition of persistence. However, results are robust to several alternative definitions. Thus, some corporations are inherently tax avoiders whereas others are not, irrespective of altering common determinants. If policymakers do not consider this aspect in their efforts of hindering tax avoidance, their regulation attempts will most likely be in vain. My results on persistence of tax avoidance do not only advance the academic knowledge about the undersheltering puzzle, they also have implications for future research on determinants of tax avoidance. First, other research should consider my results in order to identify marginal effects with greater confidence as the inclusion of firm fixed effects affects estimators. Second, my paper raises the desire to learn more about the details of time-invariant firm-specific characteristics as this study only provides a first examination of the undersheltering puzzle and its persistence over time. An investigation thereof might require exogenous shocks to identify the otherwise unobservable factors. Until then, the question of which corporations exactly are persistent and which, on the contrary, are able to continuously vary their tax avoidance level remains. A subsequent analysis in future research will certainly move us further towards solving the undersheltering puzzle.

[17] Please note that even though common determinants do not explain persistent tax avoidance, they might still be highly relevant with regard to the remaining variable part of tax avoidance.

Appendix

Figure A1. Probability of Reporting Below Average Level of Tax Avoidance



Notes: Figure A1 presents in percent how many corporations report how often below average. Values are computed by taking the ratio of number of years in which GAAP ETR is below average GAAP ETR of that year and the total number of observations per firm. On the x-axis, 1 represents that the corporation always reports below average whereas 0 indicates a very non-tax aggressive corporation. Variables are defined in table A3 of the appendix.

Table A1. Data Development

Description	Firms	Firm-Years
Compustat North America 1987-2015	31,919	357,428
Non-duplicate U.S. firms	21,742	222,452
Non-missing GAAP ETR	13,178	99,792
Non-missing Controls	11,532	86,700
Available PRIOR ETR	9,054	65,939

Notes: Table A1 presents the sample selection process. Numbers show the quantity of firms included as well as the amount of corresponding firm-year observations.

Table A2. Descriptive Statistics of Alternative Tax Avoidance Measures

Panel A: Distribution of cash effective tax rates						
	# of observations	Mean	Std. dev.	25th Percentile	Median	75th Percentile
All Firms						
CASH ETR	58,700	0.2759	0.1794	0.1447	0.2773	0.3770
DEV ETR (Cash)	58,700	0.0151	0.1899	-0.0649	0.0078	0.0930
Persistent Corporations						
CASH ETR	27,298	0.2475	0.1865	0.0741	0.2508	0.3647
DEV ETR (Cash)	27,298	0.0036	0.0867	-0.0271	0.0023	0.0335
Panel B: Distribution of foreign effective tax rates						
	# of observations	Mean	Std. dev.	25th Percentile	Median	75th Percentile
All Firms						
FOREIGN ETR	19,905	0.2998	0.1793	0.1789	0.2875	0.3931
DEV ETR (Foreign)	19,905	0.0061	0.1762	-0.0606	0.0031	0.0716
Persistent Corporations						
FOREIGN ETR	10,051	0.2815	0.1933	0.1360	0.2685	0.3884
DEV ETR (Foreign)	10,051	0.0034	0.0899	-0.0271	0.0012	0.0302

Notes: Table A2 shows descriptive statistics for the CASH ETR (panel A) and FOREIGN ETR (panel B) sample which are used in robustness checks. Table A2 presents the distribution of effective tax rates. It shows the values for the yearly ETR as well as the difference in ETRs relative to the average to reflect possible persistence of ETRs. Variables are defined in table A3 of the appendix.

Table A3. Variable Definitions

Tax Avoidance Measures	
GAAP ETR	*txt* / (*pi* - *spi*), i.e., income taxes divided by pretax income, adjusted for special items (set to 0 if missing); exclude outliers
CASH ETR	*txpd* / *pi*, i.e., income taxes paid divided by pretax income; exclude outliers
FOREIGN ETR	*txfo* / *pifo*, i.e., foreign income taxes divided by foreign pretax income; exclude outliers
RELATIVE ETR	Difference between current year's ETR and year average ETR
DEV ETR	RELATIVE ETR – RELATIVE ETR$_{-1}$, i.e., change in RELATIVE ETR
QUARTILE	Dummy variable which takes value between 1 and 4 according to which quartile of the distribution the ETR is located in. Quartiles are formed based on a year average ETR. 1 represents the lowest and 4 the highest ETRs.
PRIOR ETR / QUARTILE	Prior indicates that the respective value from the prior year, i.e., from t-1, is taken

Identification of Persistent Corporations	
PERSCORP	Indicator variable equal to 1 if today's ETR is in the same quartile as PRIOR ETR or, if specified: a) Indicator variable equal to 1 if corporation always or never reports ETR below yearly average b) Indicator variable equal to 1 if change in RELATIVE ETR is smaller than 5 %

Common Determinants	
SIZE	log (*at*), i.e., logarithm of total assets
SALES	log (*sale*), i.e., logarithm of total sales
RD (Research and Development)	*xrd* / *at*, i.e., research and development expense (set to 0 if missing) divided by total assets
LEV (Leverage)	(*dlc* + *dltt*) / *at*, i.e., debt in current and long-term liabilities (set to 0 if missing) divided by total assets; exclude LEV>1
CAPINT (Capital Intensity)	*ppent* / *at*, i.e., net property, plant, and equipment (set to 0 if missing) divided by total assets
INTANG (Intangibles)	*intan* / *at*, i.e., total intangible assets (set to 0 if missing) divided by total assets
CAPEX (Capital Expenditure)	*capx* / *ppent*, i.e., amount spent on capital assets (set to 0 if missing) divided by property, plant, and equipment
ADVEX (Advertising Expense)	*xad* / *sale*, i.e., advertising expenses (set to 0 if missing) divided by total sales
ROA (Return on Assets)	*pi* / *at*, i.e., pretax income divided by total assets
NOL (Net Operating Loss)	Indicator variable equal to 1 if tax-loss carryforward (*tlcf*) at the end of the previous year is bigger than current *tlcf*
MNE (Multinational Entity)	Indicator variable equal to 1 if pretax foreign income (*pifo*) or absolute value of foreign tax expense (*txfo*) is greater than 0
GROWTH	*sale* / (*sale* - $sale_{-1}$), i.e., increase in total sales

Notes: Table A3 presents variable definitions for all variables used throughout my analyses. All financial statement data are acquired from the database *Compustat*. *Compustat* data items are reported in italics. All continuous control variables are winsorized at the 1 % levels of their respective distribution.

Table A4. Parameter Sensitivities using Alternative Tax Avoidance Measures

Variables	CASH ETR		Change	FOREIGN ETR		Change
	1	2	3	4	5	6
SIZE	-0.0329***	-0.0391***	18.8 %	-0.0243***	-0.0120	-50.6 %
	(0.0024)	(0.0049)		(0.0055)	(0.0085)	
SALES	0.0418***	0.0673***	61.0 %	0.0258***	0.0125	-51.6 %
	(0.0025)	(0.0050)		(0.0058)	(0.0092)	
RD	-0.2800***	0.1300	-146.4 %	-0.1220***	-0.1280	4.9 %
	(0.0290)	(0.0843)		(0.0410)	(0.0780)	
LEV	-0.0907***	-0.0430***	-52.6 %	-0.0008	0.0196	255.0 %
	(0.0079)	(0.0108)		(0.0131)	(0.0172)	
CAPINT	-0.0465***	-0.0141	-69.7 %	-0.0228	0.0477	309.2 %
	(0.0079)	(0.0150)		(0.0191)	(0.0310)	
INTANG	0.0473***	0.0239*	-49.5 %	0.0565***	-0.0323	-157.2 %
	(0.0090)	(0.0141)		(0.0156)	(0.0234)	
CAPEX	-0.0147**	0.0259***	276.2 %	-0.0124	-0.0097	-21.8 %
	(0.0067)	(0.0076)		(0.0146)	(0.0149)	
ADVEX	0.0292	-0.0369	226.4 %	0.0113	0.1980	165.2 %
	(0.0493)	(0.0923)		(0.0932)	(0.1400)	
ROA	-0.1270***	-0.4260***	235.4 %	-0.1040***	-0.1710***	64.4 %
	(0.0181)	(0.0213)		(0.0247)	(0.0268)	
NOL	-0.0751***	-0.0451***	-39.9 %	-0.0117***	-0.0107***	-8.5 %
	(0.0026)	(0.0028)		(0.0037)	(0.0034)	
GROWTH	-0.0509***	-0.0319***	-37.3 %	-0.0330***	-0.0034	-89.7 %
	(0.0033)	(0.0038)		(0.0075)	(0.0074)	
MNE	0.0055**	-0.0147***	367.2 %			
	(0.0027)	(0.0036)				
Year FE	✓	✓		✓	✓	
Industry FE	✓			✓		
Firm FE		✓			✓	
N	58,700	58,700		19,905	19,905	
Adj. R^2	0.116	0.35		0.056	0.395	

Notes: Table A4 shows the results of OLS regressions with CASH ETR and FOREIGN ETR as dependent variables. Applying alternative tax avoidance measures, the results serve as robustness tests to table 5. Different sets of parameter estimates are presented to show the additional impact of including firm fixed effects (Firm FE). Also shown is the percent change in the magnitude of the coefficient when implementing Firm FE instead of Industry FE. FE are fixed effects. The constant is not reported. Robust standard errors clustered by firms are shown in parentheses. Variables are defined in table A3 of the appendix. *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

Table A5. Parameter Sensitivities considering only Persistent Corporations

Variables	GAAP ETR		Change	QUARTILE		Change
	1	2	3	4	5	6
SIZE	-0.0083**	0.0180***	316.9 %	-0.1500***	0.0895**	-159.7 %
	(0.0033)	(0.0044)		(0.0227)	(0.0350)	
SALES	0.0190***	0.0049	-74.2 %	0.1960***	0.0394	-79.9 %
	(0.0033)	(0.0045)		(0.0232)	(0.0356)	
RD	-0.5470***	-0.2680***	-51.0 %	-5.1860***	-2.0570***	-60.3 %
	(0.0311)	(0.0750)		(0.2320)	(0.5410)	
LEV	-0.0587***	-0.0210**	-64.2 %	-0.2390***	-0.0442	-81.5 %
	(0.0103)	(0.0105)		(0.0731)	(0.0816)	
CAPINT	-0.0156	0.0076	-148.7 %	-0.1320*	0.0847	-164.2 %
	(0.0105)	(0.0151)		(0.0748)	(0.1160)	
INTANG	0.0659***	-0.0282**	-142.8 %	0.5110***	-0.2230*	-143.6 %
	(0.0111)	(0.0143)		(0.0870)	(0.1140)	
CAPEX	0.0526***	0.0114*	-78.3 %	0.4060***	0.0639	-84.3 %
	(0.0085)	(0.0069)		(0.0624)	(0.0519)	
ADVEX	-0.0349	-0.0172	-50.7 %	-0.2240	-0.0649	-71.0 %
	(0.0578)	(0.0883)		(0.4970)	(0.8040)	
ROA	0.1380***	0.1700***	23.2 %	1.2720***	1.7980***	41.4 %
	(0.0236)	(0.0189)		(0.1640)	(0.1400)	
NOL	-0.0349***	-0.0174***	-50.1 %	-0.2780***	-0.1610***	-42.1 %
	(0.0032)	(0.0029)		(0.0239)	(0.0219)	
GROWTH	-0.0222***	-0.0064**	-70.1 %	-0.1550***	-0.0374	-75.9 %
	(0.0036)	(0.0033)		(0.0262)	(0.0245)	
MNE	-0.0014	-0.0103***	735.7 %	-0.2050***	-0.1340***	-34.6 %
	(0.0035)	(0.0034)		(0.0282)	(0.0297)	
Year FE	✓	✓		✓	✓	
Industry FE	✓			✓		
Firm FE		✓			✓	
N	36,065	36,065		36,065	36,065	
Adj. R^2	0.127	0.679		0.138	0.665	

Notes: Table A5 shows the results of OLS regressions with GAAP ETR and QUARTILE as dependent variables for persistent corporations only. For each measure of tax avoidance, different sets of parameter estimates are presented to show the additional impact of including firm fixed effects (Firm FE). Year FE is year fixed effects and Industry FE is industry fixed effects. Also shown is the percent change in the magnitude of the coefficient when implementing Firm FE instead of Industry FE. The constant is not reported. Robust standard errors clustered by firms are shown in parentheses. Variables are defined in table A3 of the appendix. *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

Table A6. Parameter Sensitivities using Alternative Definitions of Persistence

GAAP ETR	Always Above/Below Avg.		Change	Change < 0.05		Change
	1	2	3	4	5	6
SIZE	-0.0079	0.0026	-132.9 %	-0.0054	0.0218***	503.7 %
	(0.0055)	(0.0041)		(0.0061)	(0.0081)	
SALES	0.0215***	0.0014	-93.5 %	0.0316***	0.0041	-87.0 %
	(0.0055)	(0.0040)		(0.0060)	(0.0077)	
RD	-0.6650***	-0.0999	-85.0 %	-0.7910***	-0.0976	-87.7 %
	(0.0561)	(0.0818)		(0.0627)	(0.5010)	
LEV	-0.0617***	0.0088	-114.3 %	-0.1390***	-0.0285	-79.5 %
	(0.0159)	(0.0104)		(0.0198)	(0.0234)	
CAPINT	-0.0443**	-0.0133	-70.0 %	-0.0456**	-0.0052	-88.6 %
	(0.0175)	(0.0138)		(0.0199)	(0.0283)	
INTANG	0.0617***	-0.0084	-113.6 %	0.0913***	-0.0334	-136.6 %
	(0.0190)	(0.0176)		(0.0248)	(0.0369)	
CAPEX	0.0870***	-0.0110*	-112.6 %	0.1150***	0.0177	-84.6 %
	(0.0127)	(0.0067)		(0.0176)	(0.0141)	
ADVEX	0.1190	0.0414	-65.2 %	-0.0585	-0.1680	287.2 %
	(0.0980)	(0.0784)		(0.1360)	(0.2070)	
ROA	0.0458	-0.0340	-174.2 %	0.1820***	0.0816**	-55.2 %
	(0.0374)	(0.0227)		(0.0484)	(0.0395)	
NOL	-0.0293***	-0.0008	-97.3 %	-0.0559***	-0.0249***	-55.5 %
	(0.0057)	(0.0032)		(0.0068)	(0.0094)	
GROWTH	-0.0105**	-0.0012	-88.6 %	-0.0177**	-0.0067	-62.1 %
	(0.0048)	(0.0029)		(0.0070)	(0.0053)	
MNE	0.0127*	-0.0022	-117.3 %	0.0444***	0.0064	-85.6 %
	(0.0072)	(0.0046)		(0.0075)	(0.0112)	
Year FE	✓	✓		✓	✓	
Industry FE	✓			✓		
Firm FE		✓			✓	
N	15,548	15,548		7,394	7,394	
Adj. R^2	0.143	0.877		0.312	0.913	

Notes: Table A6 shows the results of OLS regressions with GAAP ETR as dependent variable for persistent corporations only. Applying alternative definitions of PERSCORP, the results serve as robustness tests to table 5 and table A5. Different sets of parameter estimates are presented to show the additional impact of including firm fixed effects (Firm FE). Also shown is the percent change in the magnitude of the coefficient when implementing Firm FE instead of Industry FE. FE are fixed effects. The constant is not reported. Robust standard errors clustered by firms are shown in parentheses. Variables are defined in table A3 of the appendix. *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

Table A7. Variance Decompositions using Alternative Tax Avoidance Measures

Variables	CASH ETR		FOREIGN ETR	
	1	2	3	4
Firm FE	.	93.0 %	.	98.2 %
Industry FE	6.8 %	.	17.9 %	.
Year FE	39.4 %	0.0 %	54.4 %	0.4 %
SIZE	9.4 %	1.0 %	8.6 %	0.1 %
SALES	12.3 %	1.1 %	7.0 %	0.0 %
RD	3.2 %	0.0 %	2.6 %	0.1 %
LEV	2.6 %	0.0 %	1.3 %	0.1 %
CAPINT	0.6 %	0.0 %	0.0 %	0.3 %
INTANG	0.0 %	0.0 %	0.0 %	0.1 %
CAPEX	0.0 %	0.1 %	0.0 %	0.0 %
ADVEX	0.0 %	0.0 %	0.2 %	0.0 %
ROA	1.9 %	2.7 %	2.4 %	0.6 %
NOL	20.7 %	1.6 %	4.2 %	0.2 %
GROWTH	3.0 %	0.2 %	1.3 %	0.0 %
MNE	0.0 %	0.1 %	.	.
Adj. R^2	0.730	0.802	0.744	0.839

Notes: Table A7 presents a variance decomposition for various model specifications as robustness tests to the main results in table 6. I apply alternative measures of tax avoidance: CASH ETR and FOREIGN ETR. Adjusted R-squares are shown at the bottom. I compute the Type III partial sum of squares for each parameter in the model and then normalize each estimate by the sum across all parameters. This way, I force each column to sum to 100 %. FE are fixed effects. Variables are defined in table A3 of the appendix.

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Chapter 3

Tax Avoidance through Advance Tax Rulings - Evidence from the LuxLeaks Firms

Tax Avoidance through Advance Tax Rulings

- Evidence from the LuxLeaks Firms

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Abstract:

Our empirical study tests the effect of special tax deals on tax avoidance of multinational corporations. In 2014, the International Consortium of Investigative Journalists published confidential documents identifying hundreds of firms worldwide that had benefited from advance tax rulings. We find that after engaging in an advance tax ruling in the tax haven Luxembourg, firms have lower worldwide effective tax rates compared to non-ruling firms. The results are robust even if we mitigate a potential bias via propensity score matching. Consequently, this study gives evidence for corporate tax avoidance through special tax deals in the form of advance tax rulings.

Keywords: Advance Tax Ruling, Corporate Taxation, Tax Competition, Tax Avoidance

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3.1 Introduction

Over the last decades, multinational corporations (MNCs) could benefit from various tax planning opportunities. In recent years, several countries have additionally offered special tax deals. For example, Ireland granted tax benefits to Apple for many years. In August 2016, Apple's special tax deals in Ireland were classified by the European Commission as illegal state aid resulting in $ 14.5 billion in back taxes.[18] This tax deal seems to be no exceptional case. In 2013, 32 of the OECD (Organization for Economic Cooperation and Development) countries and several non-OECD countries offered advance tax rulings (ATRs) (OECD, 2013). Generally, ATRs provide MNCs with certainty about the application of tax law. Nevertheless, lately, they appear to have become agreements in which fiscal authorities secure complex tax avoidance structures to some MNCs. In line with that, the European Commission and the OECD initiative against base erosion and profit shifting (BEPS) released actions to restrain certain types of ATRs (European Commission, 2015; OECD, 2015a). We are, to the best of our knowledge, the first to analyze the actual – until today unknown – effect of tax deals on MNCs' worldwide tax avoidance. This may be primarily due to the fact that information about ATRs is usually not disclosed by firms or tax authorities as many countries have tax secrecy.

However, in 2014, the event known as Luxembourg Leaks (LuxLeaks) has astonished governments, corporations, and the public worldwide. The International Consortium of Investigative Journalists (ICIJ) released tax documents of over 340 MNCs, including Accenture, Coach, H.J. Heinz, Procter & Gamble, Vodafone, and Volkswagen (ICIJ, 2014a/2014b).[19] *The New York Times* described Luxembourg's 'role as a haven for hundreds of companies seeking to drastically reduce their tax bills'.[20] Considering this dissemination of

[18] *The New York Times* (2016, August 30), available at http://www.nytimes.com/2016/08/31/technology/apple-tax-eu-ireland.html?_r=0.

[19] For a complete list of the involved firms see the database of the ICIJ (2014c): http://www.icij.org/project/luxembourg-leaks/explore-documents-luxembourg-leaks-database.

[20] *The New York Times* (2014, November 6), available at http://www.nytimes.com/2014/11/07/world/europe/head-of-european-commission-under-pressure-over-luxembourg-tax-revelations.html?_r=4.

confidential tax deals with the Luxembourg tax authority, we analyze the impact of special tax deals on the worldwide taxes of MNCs using a broad sample of firms.

These special tax deals in the form of ATRs are under suspicion of increasing tax competition. In the past, tax competition between countries caused decreasing corporate tax rates worldwide (Devereux, Lockwood, and Redoano, 2008; Overesch and Rincke, 2011) and many countries offered additional refined tax incentives to MNCs, such as tax holidays. Nowadays, ATRs seem to be widely used and the most intriguing method to attract MNCs. ATRs are of particular interest for tax avoidance of MNCs because sophisticated international tax avoidance structures like transfer pricing, hybrid finance, or disregarded entities are typically associated with a high risk of tax litigations (Dyreng, Hanlon, and Maydew, 2017). Furthermore, ATRs can include additional agreements with the country issuing the ATR. Thus, ATRs may comprise complex tax structures leading to almost no tax payments (ICIJ, 2014a/2014c). As they additionally provide ex ante certainty about the benefit of such structures, MNCs might even engage in tax structures which they would usually refrain from.

In our analysis, we attempt to estimate the magnitude of this - supposably - distortion of competition. We examine tax avoidance associated with special tax deals of MNCs by investigating the additional tax avoidance of firms that engage in an ATR compared to MNCs that do not. More precisely, we consider the sample of ruling firms detected by the 'LuxLeaks' publications and test whether effective tax rates (ETRs) are significantly smaller if a firm has employed an ATR. We use ETRs as a well-established measure of worldwide tax payments of a firm. A low ETR indicates reduced corporate tax payments. Thus, we expect smaller ETRs of MNCs that obtain ATRs in Luxembourg. We thereby provide an estimate of the worldwide tax reduction of an MNC due to a single tax deal.

Well-known firms identified by LuxLeaks are able to reduce their worldwide tax expenses significantly. We include the data of 136 ruling firms, i.e., firms that engaged in ATRs, which were issued and signed by fiscal authorities between 2002 and 2010, and were

exposed by the ICIJ. Our empirical analysis of data taken from *Compustat North America* and *Compustat Global* shows that the additional effect of ATRs on the multinationals' ETRs consists of a strong short-term decline by about 4 percentage points. However, over a three-year period the decline still amounts to an economically meaningful decline of 2 percentage points. Considering a mean ETR of 28 %, this leads to an average reduction of taxes by 7 %. This significant reduction implies that firms avoid taxes through tax planning strategies legally assured by ATRs. Hence, we find empirical evidence for the criticism that accompanied Luxembourg Leaks.

We also consider subsamples to compare MNCs from different countries. In accordance with the main results, we conclude that - irrespective of their location - MNCs benefit from ATRs. In additional analyses, we further find that firms which are usually less likely to engage in tax avoidance benefit especially from ATRs as they exhibit a clear long-term effect. Moreover, we combine propensity score matching and difference-in-differences estimation to mitigate the arising endogeneity concern. By selecting very similar MNCs, we reduce the threat that spurious results obtain from differences between the groups unrelated to the treatment. The matched-sample analysis is consistent with our main results that through ATRs, multinationals can avoid more taxes than they can without getting an ATR.

Our study makes several contributions to prior literature and public debates. First, it relates to previous literature that analyzes tax avoidance and for example profit shifting – as one of the possible tax avoidance structures – of MNCs (for overviews Hanlon and Heitzman, 2010; Dharmapala, 2014). A broad literature provides evidence for significant profit shifting activities of MNCs (e.g. Hines and Rice, 1994; Huizinga and Laeven, 2008). Moreover, a few studies investigate to what extent tax planning strategies like tax haven usage or proxies for well-known profit shifting channels affect the overall tax payments of an MNC (Dyreng and Lindsey, 2009; Markle and Shackelford, 2012a/2012b). However, the effect of ATRs on the scope of tax avoidance is unexplored. As MNCs arranged similar structures within the ATRs,

we confirm previous results about tax avoidance with the difference that ruling firms operate under certainty. Tax certainty may lead to increased tax avoidance. Consequently, the magnitude derived in this study provides first insight into tax avoidance under certainty.

Second, our study contributes to the general discussion on ATRs. Finding a significant reduction in ETRs, our results should be of interest for policymakers. ATRs are issued in many countries and in general, there is nothing offensive about tax certainty. However, LuxLeaks implies that ATRs may be used for means of tax abuse. Through our analyses, we offer a better understanding of the impact of certain ATRs on the scope of tax avoidance. The criticism of ATRs may be, at least with regard to Luxembourg ATRs, justified.

Related to that, our results also contribute to the recent debate on BEPS (OECD, 2015b), through which fiscal authorities aim to close loopholes. However, ATRs, as issued in Luxembourg, supposably deprive Luxembourg as well as other countries of their tax revenue as Luxembourg does not fully make use of its taxing right. The European Commission, consequently, released a 'Tax Transparency Package' to restrain MNCs - and the respective fiscal authorities - from exploiting this type of ATRs in the future (European Commission, 2015). Moreover, the final BEPS report released by the OECD includes a special action against ATRs (OECD, 2015a). Our study relates to this development as it explores the extent of tax avoidance through ATRs in Luxembourg. Our results suggest that in Luxembourg, MNCs successfully employed ATRs to reduce their overall tax payments and that Luxembourg acted as a tax haven (see also Marian, 2017). As the tax payments were legally assured through an ATR, our findings imply that not only MNCs need to comply with the rules, but also fiscal authorities have to collaborate as their behavior influences tax avoidance of MNCs.[21]

[21] In addition to the recent case of Apple in Ireland (as mentioned before), possible illegal state aid through ATRs of Amazon, Starbucks, and McDonalds in Luxembourg and the Netherlands has also caught the attention of the European Commission, cf. *The New York Times* (2015, December 3), available at http://www.nytimes.com/2015/12/04/business/eu-opens-inquiry-into-possible-mcdonalds-tax-breaks-in-luxembourg.html?_r=0.

The remainder of the paper is organized as follows. In the next section, we describe the ATRs detected by LuxLeaks and develop our hypothesis. Section 3.3 describes our data and the research design. Empirical results of our main analysis as well as additional tests are presented and discussed in section 3.4. Section 3.5 concludes.

3.2 Background and Hypothesis Development

3.2.1 Advance Tax Rulings and Luxembourg Leaks

An advance tax ruling is an agreement between a tax authority and a taxpayer about the application of tax law regarding a special arrangement (OECD, 2015a).[22] The ATR binds tax authorities to comply with the tax arrangements set out in the ATR, whereby the taxpayer obtains clarity and certainty in advance. Thus, before activities are started or a certain structure is established, the consequences of the tax planning are known (Givati, 2009; Diller, Kortebusch, Schneider, and Sureth, 2017; Hoke, 2015). Generally, ATRs are supposed to reduce tax avoidance or fraud through the increased certainty. However, an ATR does not only provide legal certainty and transparency. With regard to tax competition, a taxpayer like a MNC might also benefit from reduced corporate tax payments, i.e., special tax benefits which will be granted ex ante by the fiscal authority (Diller et al., 2017; Sheppard, 2015).

A 2013 OECD report reveals that 32 of the OECD countries and several non-OECD countries offer ATRs (OECD, 2013), but only recently, ATRs have been in the center of public discussion because several hundred confidential documents were published online by the ICIJ (ICIJ, 2014c). Unlike the U.S. Internal Revenue Service, in most European countries, fiscal authorities do not disclose information about issued ATRs. However, in late 2014, tax documents of over 340 MNCs became publicly available. Most of the confidential documents

[22] ATRs are in some ways similar to advance pricing agreements (APAs). De Waegenaere, Sansing and Wielhouwer (2007) examine APAs and what circumstances increase the likelihood of engaging in an APA. However, they do not relate APAs to the ETRs of MNCs. Further, APAs generally represent documents to which several fiscal authorities agree and are especially used to determine transfer prices. The in this study examined ATRs have been signed only by Luxembourg fiscal authority and comprise more versatile tax planning structures. Thus, from them, we can infer if tax planning structures in one country can affect the worldwide corporate ETR.

represent ATRs, which were issued between 2002 and 2010, and indicate sophisticated tax planning activities in Luxembourg (ICIJ, 2014a/2014c).

Technically, ATRs are written affirmations of planned tax structures. Elaborate, tax-motivated structures, mostly proposed by the Big Four accountancy firm PwC and signed by Luxembourg tax administration, imply a distortion of competition and thus, possibly illegal state aid as selected MNCs gain certainty about unnaturally low tax payments through secret tax deals (Christians, 2014; Soong Johnston and Parillo, 2014). Obviously, ATRs are advantageous for MNCs: This study focusses on the reduced tax payments whereas Huesecken, Overesch, and Tassius (2017) show an increase in firm value associated with ATRs. However, Luxembourg also benefits from signing the documents. It attracts business and tax revenue as defined in the ATR.[23] Considering the frequent lack of real economic activities (Hoke, 2015), ATRs might even be a matter of aggressive tax avoidance.

The documents can be downloaded from the database provided by the ICIJ (ICIJ, 2014c). The released documents explain the used tax structures and Marian (2017) as well as Hardeck and Wittenstein (2017) analyze them in detail. Among other schemes to avoid taxes, some ruling firms set up finance companies in Luxembourg. Equipping those with equity via hybrid financing, such as participation rights, has the advantage that the capital can be classified as equity in the host country of the parent company whereas in Luxembourg, it can be seen as debt. The finance company gives intra-company loans to other subsidiaries in high-tax countries where the interest expenses are tax deductible. In Luxembourg, payments to the parent company are classified as interest and equally tax deductible - ideally reducing the tax base to zero, whereas the host country of the parent company does not tax the payment because it is deemed as intra-company dividend. Other ruling firms use fund structures in which the profit is shifted

[23] At this point, it should be noted that ATRs, in general, are nothing illegal or offensive. However, if a state uses them to act as a tax haven and to offer special tax avoidance structures to certain MNCs, the usage of these discriminatory ATRs may be investigated and restricted as the European Commission recently did (European Commission, 2015). For a timeline of events associated with LuxLeaks compare figure A1 of the appendix.

to a Luxembourg investment fund, because according to Luxembourg law, funds are mostly tax-exempt. Yet other ATRs display the application of intellectual property which is held in a Luxembourg subsidiary. 80 % of the in Luxembourg received royalty payments are tax-exempt due to the available 'IP-Box' in Luxembourg tax law. While the general structures may also be available to MNCs without an ATR, ATRs often consist of even more elaborate structures and additionally warrant unconventional agreements, such as transfer prices that are not in line with market terms and maximum tax bases irrespective of the earned profit.[24] Luxembourg state aid legally assuring major reductions of tax payments embodies that the analyzed ATRs serve as tax avoidance structure for MNCs and allows us to investigate their impact on MNCs' worldwide ETRs.

3.2.2 Prior Literature and Hypothesis

Tax planning activities of MNCs have received a lot of attention in recent years. MNCs employ very different strategies to avoid taxes: A broad literature provides evidence for income shifting (see Hines and Rice, 1994; Huizinga and Laeven, 2008; Heckemeyer and Overesch, 2017) and tax optimal financial structures (Desai, Foley, and Hines, 2004; Huizinga, Laeven, and Nicodème, 2008). Moreover, MNCs establish subsidiaries in tax haven countries (Desai, Foley, and Hines, 2006) or locate patents in countries offering a special tax treatment (Karkinsky and Riedel, 2012; Griffith, Miller, and O'Connell, 2014).

The previous literature has also investigated the influence of certain tax planning tools on the worldwide tax avoidance of a MNC. This literature refers to ETRs taken from financial accounting data as a measure of tax avoidance. Several studies analyze the influence of firm-specific characteristics (Gupta and Newberry, 1997; Plesko, 2003; Chen, Chen, Cheng, and Shevlin, 2010) and provide insight into the impact of foreign activities and international tax planning (Collins and Shackelford, 1995/2003; Rego, 2003). Only a few studies investigate the

[24] This structure, applied by Amazon, is investigated by the European Commission as it might represent illegal state aid (Soong Johnston and Parillo, 2014).

influence of selected tax planning strategies. Dyreng and Lindsey (2009) and Markle and Shackelford (2012a/2012b) test proxies for well-known profit shifting channels as determinants of tax avoidance. We contribute to this strand of literature as we analyze the impact of ATRs on the scope of tax avoidance. Even though similar structures – as described above – have been used in ATRs, the reduced litigation risk may impact the magnitude of tax avoidance.

Studying the relation of tax avoidance and tax uncertainty, Dyreng et al. (2017) reveal that income shifting to tax havens increases uncertainty. ATRs, however, provide legal certainty. Diller et al. (2017) find a high demand for ATRs and show how their availability attracts tax aggressive MNCs. We expect that reaching tax certainty is not the only reason for MNCs to get an ATR. In fact, we expect that by having an ex ante acceptance of their tax structure, MNCs can implement tax structures that are otherwise associated with high risk of tax litigations. Without an ATR those MNCs would potentially have to fear a tax audit and consequently, might refrain from engaging in aggressive tax planning. However, managers, supported by their tax advisor, most likely saw the chance in Luxembourg to get their tax planning accepted even though the structures seem to be highly tax-motivated. Therefore, from the MNC's perspective, the intention behind an ATR strikes as being additional tax avoidance.

Taking into account previous literature, we study whether and to what extent ATRs affect worldwide corporate tax avoidance of MNCs. We hypothesize that ETRs of MNCs employing ATRs are significantly smaller than those of firms that do not get an ATR.

3.3 Research Design and Sample

3.3.1 Data and Sample Selection

Our starting point are the 345 ruling firms identified by the ICIJ as mentioned in section 3.2.1. We manually searched for the ultimate parent.[25] To augment our sample, we

[25] During the observed period, we identify several cases of mergers and acquisitions, for which, if data is available, we keep all affected firms. We expect tax aggressiveness to be extended to the acquiring firm as well as to the newly created entity in case of a merger.

derive consolidated financial statement information from two databases: *Compustat North America* and *Compustat Global*. By merging the two datasets,[26] we acquire data for 164 ruling firms. We consider only financial years that ended between January 2000 and December 2014. Thus, we get 60,452 firms, of which 162 represent ruling firms, or 564,563 and 2,197 firm-year observations, respectively. Imposing the following data requirements, which we need for our regression analyses, we are left with a total of 5,774 firms (136 ruling firms) or 35,312 (1,240) firm-year observations (see table A2 of the appendix for detailed data development).

For our treatment group (ruling firms), we require available ruling documents so that we can identify the year of the ATR. Since tax avoidance mostly involves the exploitation of different tax jurisdictions, we limit our sample to MNCs. By default, all ruling firms are MNCs due to their additional activity in Luxembourg. A few ruling firms are headquartered in Luxembourg. For those, we manually check their Internet presence to ensure their multinationality. Following Dyreng and Lindsey (2009) and Atwood, Huston, and Wallace (2013), we identify the control group (non-ruling firms) as multinational if they have a non-missing and non-zero foreign income tax. As this variable is not available in *Compustat Global*, we extract the respective data items from *Compustat Global Legacy*, which provides financial data till 2008.[27] We classify a firm as a MNC if it is considered to be multinational in a previous firm-year (Atwood et al., 2012). Tax avoidance opportunities highly depend on a country's tax law. Therefore, we require our control group to be headquartered in the same countries as the considered ruling firms.

Financial statement information is needed to compute the tax avoidance measures as well as additional variables for regression analyses. Hence, we require that each firm-year observation has comprehensive financial data. Firm-years with missing variables are excluded.

[26] Prior to the merge, we require non-missing values for company identifier (gvkey), year (fyear), and industry format (indfmt), as the two datasets are merged based on these variables. We delete duplicate observations.
[27] According to Atwood, Drake, Myers, and Myers (2012) Japanese firms have unreasonably often missing foreign tax and can consequently not be identified as multinationals. Therefore, we delete Japanese firms from our sample.

For the control variables, we need non-missing values for the respective described components.[28] Loss firms usually have different tax planning incentives than profitable firms. Thus, we limit our sample to firms having a positive pretax income.

Following accounting literature, we use the ETR as an ex post measure of tax avoidance (e.g. Hanlon and Slemrod, 2009; Dyreng, Hanlon, and Maydew, 2010; Markle and Shackelford, 2012a/2012b). Information to compute our ETR measures is taken from the consolidated financial statements of MNCs. Consequently, the ETR considers the overall effects of tax avoidance structures in different countries and does not refer to one single subsidiary. Backward-looking, the ETR evaluates the worldwide tax expenses of a firm and thus, indicates the level of employed tax avoidance. A lower ETR implies higher tax avoidance as the firm seems to have tax planning structures that reduce the income taxes more effectively compared to firms with higher ETRs.[29]

Table 1. Summary Statistics

Variables	Treatment Group			Control Group		
	N	Mean	Std. dev.	N	Mean	Std. dev.
GAAP ETR	1,240	0.28	0.14	34,072	0.28	0.15
SIZE	1,240	9.49	2.25	34,072	6.75	2.04
ROA	1,240	0.08	0.08	34,072	0.10	0.28
CAPINT	1,240	0.31	0.26	34,072	0.35	0.27
LEV	1,240	0.07	0.10	34,072	0.05	0.08
RD	1,240	0.02	0.03	34,072	0.02	0.05
CASH ETR	858	0.25	0.15	26,080	0.24	0.17
FOREIGN ETR	362	0.30	0.17	11,453	0.29	0.17

Notes: Table 1 shows descriptive statistics for all variables included in our main regression analyses. Variables are defined in table A1 of the appendix.

In our main analysis, we focus on a firm's GAAP ETR as dependent variable. We define GAAP ETR as tax expenses divided by pretax income and adjust the latter for extraordinary items. In accordance with previous studies, we delete a firm-year if the numerator or

[28] Please refer to section 3.3.3 for a description of the control variables.
[29] The ETR used in this study is not to be confused with the effective tax rate as described in King and Fullerton (1984) and Devereux and Griffith (1998) who define it differently as a forward-looking measure.

denominator of the ETR is negative and to limit the influence of outliers, we exclude ETRs smaller than 0 and greater than 1. Finally, we exclude the observations of the specific year the ATR was signed from our analysis.

Table 1 presents summary statistics for several firm characteristics.[30] The descriptive statistics show that the 136 firms of our sample identified as ruling firms are, compared to our full sample, rather large and thus, represent a relevant part of the available market volume. Overall, treatment and control group are comparable regarding firm characteristics. Ruling firms have a lower capital intensity and a higher short-term leverage than the control group. Their profitability is slightly lower. The presented values are reasonable and as prior literature (see section 3.3.3) presents ambiguous results, this gives us no clear indication regarding possible tax avoidance behavior.

Table 2 provides additional information regarding the ruling firms. It exposes that most ruling firms are headquartered in the United States (34.6 %), followed by the United Kingdom (16.2 %), and Germany (6.6 %). 33.8 % of the ruling firms belong to the financial sector and still 9.6 % can be classified as dealing with pharmaceutical products.[31] Some MNCs signed more than one ATR with Luxembourg fiscal authority. In most of our later analyses, we, however, only consider each MNC's first ATR.

[30] A correlation matrix of the variables is provided in table A3 of the appendix.
[31] We apply the Fama and French classification of 17 industry codes. Updated industry classification can be downloaded from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/changes_ind.html.

Table 2. Overview of Firms

Country	Frequency Ruling	Frequency Non-R.	Industry	Frequency Ruling	Frequency Non-R.	Year of Ruling	Frequency
Australia	5	27	Food	6	176	2002	1
Belgium	4	8	Mining & Minerals	2	106	2003	2
Bermuda	1	44	Oil and Petroleum			2004	1
Canada	5	171	Products	5	158	2005	1
Switzerland	8	27	Textiles, Apparel &			2006	2
Germany	9	169	Footware	4	163	2007	2
Finland	1	15	Consumer Durables	2	204	2008	25
France	5	48	Chemicals	1	140	2009	82
Hong Kong	1	801	Drugs, Soap, Prfums,			2010	55
Ireland	9	60	Tobacco	13	182		
Iceland	1	0	Construction and				
Israel	1	52	Construction Materials	4	203		
Italy	5	28	Steel Works	1	87		
Luxembourg	4	14	Fabricated Products	2	47		
Netherlands	1	51	Machinery and				
Norway	1	62	Business Equipment	10	879		
Philippines	1	3	Automobiles	3	96		
Russia	2	5	Transportation	2	202		
Sweden	2	34	Utilities	1	46		
Taiwan	1	16	Retail Stores	3	240		
United Kingdom	22	870	Banks, Insurance Companies				
United States	47	3,133	& Other Financials	46	627		
			Other	31	2,082		
Total	136	5,638		136	5,638		171

Notes: Table 2 gives an overview of descriptive information of the in the analyses considered ruling firms and non-ruling (Non-R.) firms as it summarizes the country of the headquarter and the industry. The industry classification is based on the 17 different industries from Fama and French. The years in which ATRs have been signed by Luxembourg tax administration are also displayed. Note that 'Year of Ruling', based on the database provided by the ICIJ, does not equal the later employed indicator variable RULING FIRM & PERIOD as it accounts for firms that requested more than one ATR.

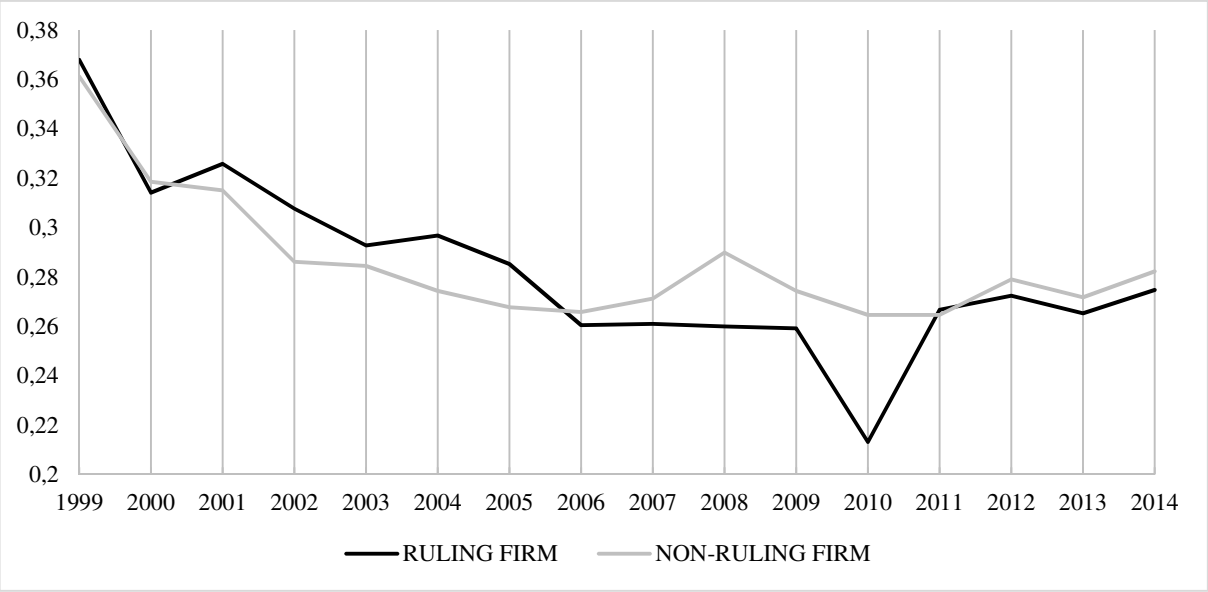
3.3.2 Explorative Analyses

As discussed in section 3.2.2, we expect a causal relationship between rulings and tax avoidance. While table 1 does not support significant differences in the ETR of ruling firms and non-ruling firms, a closer look at the development of the data over time in figure 1 indicates a first support for our hypothesis.

Figure 1 illustrates the mean GAAP ETRs for ruling and non-ruling firms from 1999 until 2014. The starting point for the GAAP ETRs of both groups lies at approximately 36 %. Seen in the long term, the GAAP ETR of ruling firms decreases only slightly more than that of

non-ruling firms. However, there is a remarkable gap between the two groups in the years 2009 to 2011. Interestingly, most Luxembourg ATRs have been issued between 2008 and 2010 (94.7 % of the 136 ruling firms' published tax rulings).[32] Therefore, the explorative analysis suggests a short-term treatment effect on ruling firms. Considering that both groups behave again similarly by the end of the observed period, a long-term effect seems less probable.

Figure 1. GAAP ETR – Development over Time



Notes: Figure 1 presents the mean values for GAAP ETR as tax avoidance measure in each observed year. It differentiates between ruling and non-ruling firms to show the differences in development over time. Variables are defined in table A1 of the appendix.

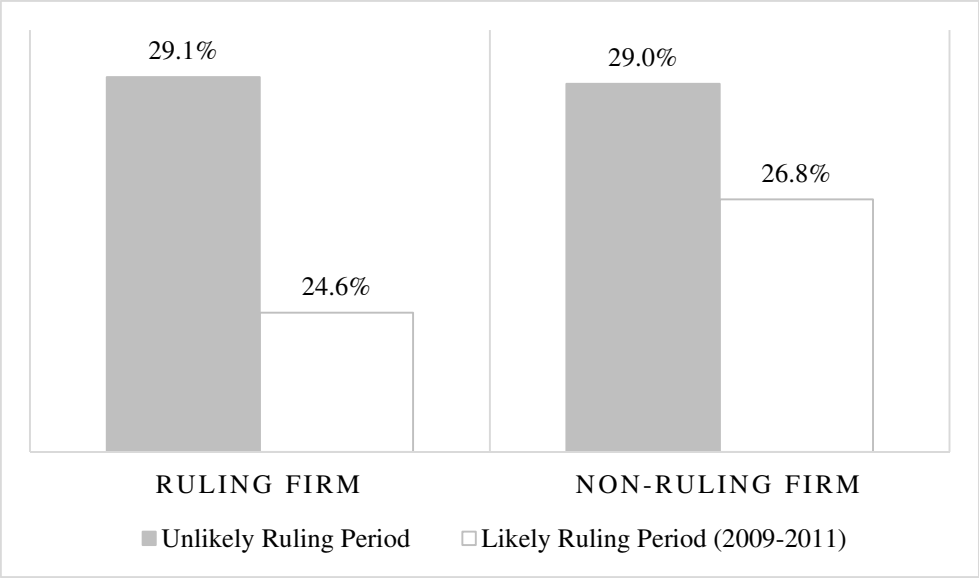
Figure 2 also provides mean values of GAAP ETR for ruling and non-ruling firms. Here, we further distinguish between years 2009 to 2011 and other periods when almost no ruling became effective. We consider the years 2009 to 2011 as the likely ruling period[33], because most ATRs were issued in 2008 to 2010. Moreover, we assume that the effect of a new ATR emerges in the year after the corresponding ruling. Figure 2 depicts that the mean GAAP ETR

[32] We manually checked all available ruling documents published by the ICIJ. As illustrated in table 2, the 136 ruling firms of our sample engaged in a total of 171 ATRs, of which 25, 82 and 55 were issued in 2008, 2009, and 2010, respectively. The remaining 9 rulings divide into 2002 to 2007. Note that in our analyses the ruling effect can occur after 2010 due to our definition of RULING PERIOD. Please refer to section 3.3.3 for a detailed explanation of RULING PERIOD.

[33] We acknowledge that applying the exact ruling period (RULING PERIOD) would enhance the accuracy of the depicted mean ETRs. However, by employing the likely ruling period, we are able to compare the ETRs of treatment and control group in relation to the (likely) date of the ATR. Note that otherwise, by definition of RULING PERIOD, there would be only a non-ruling period for the control group.

for ruling firms decreases by 4.5 percentage points from 29.1 % to 24.6 % in the period in which rulings are the most likely. In the same period that is from 2009 to 2011, the mean GAAP ETR for non-ruling firms also decreased compared to other years, but the reduction amounts only to 2.2 percentage points. Ruling firms clearly experience a more distinctive decline in ETR. The additional effect indicates again a relationship between ATRs and tax avoidance.

Figure 2. GAAP ETR – Mean Values



Notes: Figure 2 presents the mean values of GAAP ETR for ruling and non-ruling firms. It considers the values of the likely ruling period that is years 2009 to 2011, because most ATRs were issued in 2008 to 2010 (we expect an effect in the year after the ruling). All other years are unlikely ruling periods. Variables are defined in table A1 of the appendix.

Defining ruling period more precisely, i.e., accounting for each firm's individual first time ruling, leads to a significant decrease in GAAP ETR by 5.8 percentage points from 28.2 % to 22.4 %. Consequently, tax avoidance seems to be very pronounced for ruling firms during the respective ruling period implying that MNCs exploit this legally assured Luxembourg tax shelter. This explorative analysis of our sample strongly hints at a relationship between ATRs and tax avoidance and thus, offers a first endorsement of our expectation that engaging in an ATR allows to considerably reduce the firm's ETR. Nevertheless, to provide convincing evidence a multivariate data analysis is needed. Therefore, in section 3.4, as described in the

subsequent research design, we will use regression analyses to further identify the effect of ATRs on tax avoidance.

3.3.3 Research Design

In accordance with our research question, we test the effect of ATRs in Luxembourg on tax avoidance by applying a fixed effects panel regression model. Equation (1) represents our standard empirical model that analyzes tax avoidance, defined as a decreasing ETR, through ATRs of firm *i* in year *t*.

$$\begin{aligned} ETR_{it} = {} & \beta_0 + \beta_1\, RULING\ FIRM\ \&\ PERIOD_{it} \\ & + \beta_2\, SIZE_{it} + \beta_3\, ROA_{it} + \beta_4\, CAPINT_{it} + \beta_5\, LEV_{it} + \beta_6\, RD_{it} \\ & + Year\ Fixed\ Effects + Firm\ Fixed\ Effects + u_{it} \end{aligned} \quad (1)$$

RULING FIRM & PERIOD is an indicator variable, which equals 1 if ATRs of that firm have been uncovered by ICIJ and the ATR is expected to be effective during the year *t*. We account for the fact that ATRs have been issued in different years by manually checking the available documents for the date of the MNC's first ATR. If a firm signed more than one ATR, we consider only the first ATR. RULING FIRM & PERIOD is our variable of interest. Its coefficient β_1 captures the additional tax avoidance of ruling firms if the ATR is effective compared to non-ruling firms and the general time trend. We expect a significant negative effect, which would signify an increase in tax avoidance of ruling firms after the respective ATR and thus, support our hypothesis. Furthermore, in all our regressions, we include year fixed effects to control for the general time trend in tax avoidance and business cycle effects. Moreover, due to differing tax avoidance opportunities across industries (Balakrishnan, Blouin, and Guay, 2017), we include industry fixed effects according to the Fama and French classification of 17 different industry groups. In most specifications, we, however, consider firm fixed effects to completely eliminate time-invariant heterogeneity between the firms.

In our main analysis, we assume that the ATR is effective only in the year after the ATR was signed by the fiscal authority.[34] Considering further years as ruling period makes it more difficult to clearly identify an effect of ATRs as other events or additional tax planning may affect our results. Nevertheless, in additional analyses, we further explore a potential long-term effect and test the robustness of our results to alternative definitions of the ruling period.

Furthermore, we consider several determinants of tax avoidance that have been considered in previous literature.[35] We consider SIZE measured as the logarithm of total assets. We have no clear prediction regarding the influence of SIZE on the ETR, because prior studies reveal a positive correlation (Plesko, 2003; Rego, 2003; Wang, 1991; Zimmermann, 1983) as well as a negative correlation (Chen et al., 2010).

The variable ROA (return on assets) is a measure of profitability and defined as the quotient of pretax income and total assets. Profitable firms have higher incentives to engage in tax avoidance resulting in a negative correlation between tax avoidance, i.e., ETRs and profitability (Chen et al., 2010; Gupta and Newberry, 1997; Plesko, 2003). However, some studies find a positive correlation (Rego, 2003).

CAPINT measured as property, plant, and equipment divided by total assets might also influence the ETR.[36] A high level of capital intensity can cause a reduction in taxes due to higher depreciations (Gupta and Newberry, 1997). However, higher depreciations also affect pretax income, which can mitigate the negative correlation (Plesko, 2003). Higher capital intensity can further signify less mobility of taxable income.

We further consider LEV,[37] which is measured as the quotient of liabilities and total assets. Leverage also has an ambiguous influence on tax avoidance (Markle and Shackelford,

[34] We exclude the specific year of the ATR from our analysis as ATRs have been issued at different points of time during the year and thus, it is not clear whether or not we can already expect an effect of the ATR.
[35] Compare table A1 of the appendix for variable definitions and table 1 for descriptive statistics of the variables. Further note that we require non-missing values for all components of the variables unless otherwise indicated.
[36] We exclude observations with capital intensity higher than 1.
[37] We exclude observations with leverage higher than 1.

2012b; Chen et al., 2010). According to prior research, high leverage results in deductibility of interest expenses and reduces tax expenses but it also reduces the pretax income (Hanlon and Heitzman, 2010).

RD is defined as research and development expenses divided by total assets and set to 0 if missing. The variable indicates high mobility of income (Grubert, 2003; Harris, 1993). Consequently, higher RD allows for more profit shifting opportunities and we expect a negative correlation between RD and the ETR.

3.4 Empirical Results

3.4.1 Regression Analyses

The following empirical analyses test our research question as they explore the effect of engaging in an ATR in Luxembourg on tax avoidance of MNCs. We anticipate ruling firms to avoid taxes more effectively than non-ruling firms as we assume ATRs to be a method of corporate tax avoidance. Our main estimation results are presented in table 3. Robust standard errors clustered by firms are applied in all our analyses. Table A4 of the appendix shows that estimates with standard errors clustered by industry are consistent with reported results.

In specifications (1) to (3), we use GAAP ETR as dependent variable. Specification (1) reports results considering only year and industry fixed effects as control variables. In specification (2), we add other determinants of tax planning as described in section 3.3.3. Specification (3) repeats the analysis of specification (2), however, instead of industry fixed effects, we apply firm fixed effects. Consequently, the variable RULING FIRM is omitted.[38]

[38] In further tests (cf. table A4 of the appendix), we employ additional control variables, such as a measure of income mobile (dummy for pharmaceuticals, computers, and services), of intangibles (intangible assets scaled by total assets), and of sales growth (increase in net turnover divided by last year's net turnover). Furthermore, we control for the statutory tax rate (as found in the worldwide corporate tax summaries of PwC, KPMG, and EY) of the MNC's home country and include squares of the employed variables. The measured effect on tax avoidance remains significant and the magnitude is mostly consistent with results reported in table 3. For the sake of clarity, we did not include the additional controls in our main analyses as some are similar to the ones already shown and others drastically reduce sample size due to data availability.

In all three specifications, the coefficient of RULING FIRM & PERIOD is negative and statistically significant. As we account for the possible downward trend over time by including year fixed effects in all our regression analyses, the results can be interpreted to imply that ruling firms' GAAP ETR decreased significantly after the ATR. The magnitude of tax avoidance that the 136 considered ruling firms achieve by applying ATRs lies at a reduction of ETR by approximately 4 percentage points (coefficient: -0.0403). Considering the worldwide mean ETR of 28 % as displayed in table 1, this represents roughly 14 % less taxes that a corporation had to pay after engaging in an ATR. Looking for example at the case of Procter & Gamble, which reports an ETR of 29.7 % in the year prior to the ATR (implying $ 4.37 billion of income taxes)[39], the approximate ETR reduction of 4 percentage points generates tax savings amounting to $ 590 million, ceteris paribus. Thus, the economic relevance of the detected effect becomes obvious as it enables MNCs to substantially reduce their tax expenses. The results are consistent with our hypothesis. Across all specifications, our results suggest that the ATR allows the MNC to implement successful tax avoidance strategies. The coefficient of RULING FIRM remains insignificant over specifications (1) and (2). Thus, we identify no general difference regarding the ETR between ruling and non-ruling firms irrespective of the ATR.

In specifications (2) and (3), GAAP ETR is significantly and positively related to SIZE and CAPINT, but negatively related to ROA. Applying firm fixed effects yields a positive association with LEV. As we had no clear predictions, these findings are consistent with expectations from prior literature. Regarding RD in specifications (2) and (3), we find, as expected, a negative relation with our tax avoidance measure. Firms with high research & development are able to avoid more taxes.

[39] Data is taken from the 2007 annual report of Procter & Gamble, available at http://www.pginvestor.com/Cache/1001181146.PDF?O=PDF&T=&Y=&D=&FID=1001181146&iid=4004124.

Table 3. Main Regression Analyses

Variables	GAAP ETR			add. rulings	2y. prior	2y. later	CASH ETR	FOREIGN ETR
	1	2	3	4	5	6	7	8
RULING FIRM & PERIOD	-0.0441***	-0.0468***	-0.0403***	-0.0370***	-0.0190	-0.0013	-0.0277*	-0.0159
	(0.0113)	(0.0112)	(0.0104)	(0.0100)	(0.0124)	(0.0180)	(0.0168)	(0.0229)
RULING FIRM	0.0069	-0.0068						
	(0.0071)	(0.0074)						
SIZE		0.0056***	0.0144***	0.0144***	0.0145***	0.0139***	0.0179***	0.0046
		(0.0008)	(0.0031)	(0.0031)	(0.0031)	(0.0031)	(0.0045)	(0.0069)
ROA		-0.0297***	-0.0582***	-0.0582***	-0.0583***	-0.0582***	-0.0916**	-0.0865**
		(0.0113)	(0.0196)	(0.0196)	(0.0196)	(0.0196)	(0.0387)	(0.0351)
CAPINT		0.0148**	0.0283**	0.0283**	0.0277**	0.0273**	0.0448***	0.0256
		(0.0061)	(0.0124)	(0.0124)	(0.0124)	(0.0124)	(0.0168)	(0.0288)
LEV		-0.0825***	0.0748***	0.0749***	0.0755***	0.0758***	0.1010***	0.0363
		(0.0175)	(0.0195)	(0.0195)	(0.0196)	(0.0195)	(0.0254)	(0.0426)
RD		-0.1680***	-0.0356	-0.0357	-0.0344	-0.0377	0.3520***	0.1940
		(0.0292)	(0.0702)	(0.0702)	(0.0703)	(0.0702)	(0.0899)	(0.1490)
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Industry FE	✓	✓						
Firm FE			✓	✓	✓	✓	✓	✓
N	35,312	35,312	35,312	35,307	35,296	35,304	26,938	11,815
Ruling Firms	136	136	136	136	136	136	66	26
Adj. R^2	0.028	0.042	0.436	0.436	0.435	0.435	0.337	0.394

Notes: Table 3 presents the results of our main OLS regressions. Specifications (1) to (6) of table 3 present the results with GAAP ETR as dependent variable. In specifications (1) and (2), we apply year fixed effects as well as industry fixed effects and add general (SIZE, ROA, CAPINT, LEV) and international (RD) determinants of tax avoidance. In specification (3), we use firm fixed effects. In specification (4), the effect of a firm engaging in additional ATRs is accounted for by including the year following such an ATR in RULING FIRM & PERIOD. Specifications (5) and (6) shift the year of the ATR by two years. Specifications (7) and (8) use alternative measures of tax avoidance. In specification (8), the sample is limited to U.S. firms due to availability of data. The constant is not reported. Robust standard errors clustered by firms are shown in parentheses. FE are fixed effects. Variables are defined in table A1 of the appendix. *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

In additional analyses, we perform several robustness tests to ensure the credibility of our main results.[40] We consider the same sample as before and as described in section 3.3.1. Furthermore, we employ the same regression as in specification (3), i.e., using the same control variables and firm fixed effects.

In specification (4), we account for the fact that some ruling firms requested more than one ATR. RULING FIRM & PERIOD is therefore also set to 1 for the year after each ATR if a firm signed additional ATRs.[41] This definition assumes that each ATR affects the MNC's tax avoidance. The result for the variable of interest is still negative and highly significant. Moreover, the magnitude of the point estimator (-0.0370) is very similar to our main result in specification (3) (-0.0403).

With specifications (5) and (6), we test whether RULING FIRM & PERIOD truly captures the effect of the revealed ATRs. As placebo tests, we shift the year of the first ATR by two years in each direction.[42] All other assumptions remain unchanged compared to our original definition of RULING FIRM & PERIOD. We expect no significant estimation coefficients. The results are consistent with our expectation and thus, suggest support for our hypothesis.

As prior literature has applied diverse definitions of ETR as tax avoidance measure (Dyreng, Hanlon, and Maydew, 2008; Hanlon and Heitzman, 2010; Hope, Ma, and Thomas, 2013), we consider CASH ETR and FOREIGN ETR in specifications (7) and (8) of table 3. We expect a significant increase in tax avoidance (i.e., lower ETR) regardless of the chosen tax avoidance measure.

We now also require non-missing values for different variables according to the alternative definitions.[43] Requiring data for CASH ETR, which is the quotient of income taxes

[40] Results of additional robustness tests are shown in table A4 of the appendix. For example, most ATRs have been signed in 2009 and 2010. Limiting the sample to those firms confirms prior results.
[41] If the year of the ATR does not simultaneously represent a year after another ATR, RULING FIRM & PERIOD is set to missing for that observation. As a result, our sample size is reduced by 5 observations.
[42] Our sample size changes slightly as now other firm-year observations are set to missing.
[43] Again, outliers, ETR<0 and ETR>1, are excluded.

paid and pretax income (Dyreng et al., 2008), reduces our sample in specification (7). The coefficient of interest is still significant (-0.0277). In specification (8), following Hope et al. (2013), we consider FOREIGN ETR, which is defined as foreign income taxes divided by foreign pretax income. Due to data availability, we limit our sample to firms headquartered in the U.S.. The result still indicates a negative relation between RULING FIRM & PERIOD and ETR (-0.0159), however, it is insignificant. The insignificance may be the result of the strongly decreased sample size as a re-estimation of the same sample using GAAP ETR also becomes less significant (cf. table A4 of the appendix). All things considered, the results in specifications (7) and (8) are in line with our expectation and are consistent with previous results as well as with our hypothesis.

Our results suggest that by engaging in an ATR in Luxembourg, MNCs are able to significantly reduce their ETR compared to non-ruling firms, i.e., a single beneficial tax deal in a small tax haven can impact the worldwide corporate ETR. We conclude that ATRs represent a legally assured tax avoidance structure for MNCs. In subsequent sections we execute cross-sectional analyses to further explore the identified effect and provide additional information on who benefits from ATRs.

3.4.2 MNCs from Different Countries

As described in section 3.3.1, most ruling firms are headquartered in the United States, followed by European countries like the United Kingdom or Germany. In recent years, in particular, U.S. MNCs, such as Apple Inc., Amazon Inc., and Wal-Mart Stores Inc., have been publicly criticized for their aggressive tax avoidance (e.g. Sheppard, 2015).[44] Prior research suggests an influence of differing home country tax systems (Atwood et al., 2012). Due to, for example, different applicable CFC legislations, firms headquartered in the European Union

[44] See also *BloombergBusiness* (2015, June 17), available at http://www.bloomberg.com/news/articles/2015-06-17/wal-mart-has-76-billion-in-overseas-tax-havens-report-says, and *The New York Times* (2012, April 28), available at http://www.nytimes.com/2012/04/29/business/apples-tax-strategy-aims-at-low-tax-states-and-nations.html.

(EU) cannot as easily apply some of the known aggressive tax planning structures. However, having an available tax avoidance opportunity in its geographic center, EU firms might be able to engage in additional tax avoidance.

Table 4. MNCs from Different Countries

Dependent Variable: GAAP ETR	U.S. Sample		U.S. vs EU	U.S. vs GBR	U.S. vs DE
	1	2	3	4	5
RULING FIRM & PERIOD	-0.0332**	-0.0460**	-0.0335**	-0.0328*	-0.0350**
	(0.0167)	(0.0219)	(0.0170)	(0.0170)	(0.0169)
RULING FIRM & PERIOD x NON-US			0.0088	0.0003	-0.0158
			(0.0221)	(0.0246)	(0.0355)
SIZE	0.0092**	0.0087*	0.0099***	0.0121***	0.0096**
	(0.0046)	(0.0046)	(0.0037)	(0.0039)	(0.0043)
ROA	-0.1100***	-0.1100***	-0.1630***	-0.1450***	-0.1110***
	(0.0280)	(0.0280)	(0.0322)	(0.0301)	(0.0245)
CAPINT	0.0150	0.0164	0.0347**	0.0207	0.0254
	(0.0181)	(0.0182)	(0.0154)	(0.0167)	(0.0163)
LEV	0.0724***	0.0729***	0.0688***	0.0734***	0.0558**
	(0.0261)	(0.0262)	(0.0224)	(0.0233)	(0.0245)
RD	-0.0536	-0.0587	-0.1110	-0.0997	-0.0957
	(0.1070)	(0.1070)	(0.0780)	(0.0843)	(0.0906)
NOL	-0.0047	-0.0044			
	(0.0029)	(0.0029)			
Year FE	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓
N	17,419	17,311	27,291	24,183	19,919
Ruling Firms	46	34	110	69	56
Adj. R^2	0.392	0.391	0.389	0.393	0.378

Notes: Table 4 analyzes the effect of ATRs on MNCs from different countries. Specifications (1) and (2) account for U.S. firms only. Specification (2) accounts for the possible influence of a newly created Luxembourg subsidiary. Specifications (3) to (5) show the effect of ATRs on non-U.S. firms compared to U.S. firms. The variable NON-US includes European, British, and German firms in specification (3), (4), and (5), respectively. Other variables are defined in table A1 of the appendix. FE are fixed effects. The constant is not reported. Robust standard errors clustered by firms are shown in parentheses. *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

In table 4, we therefore analyze subsamples including firms from different countries. At first, we consider only U.S. firms and then, compare European, British, and German firms to the U.S. sample. The U.S. sample, examined in specification (1), includes 46 ruling firms. The point estimate for RULING FIRM & PERIOD is negative and significant (-0.0332). Hence, the

result for U.S. firms implies a decrease in GAAP ETR by approximately 3.3 percentage points and thus, an increase in tax avoidance, which is consistent with our main findings.

Given that our data solely consists of Luxembourg ATRs, one might argue that the measured effect is highly influenced by having a Luxembourg, i.e., a tax haven subsidiary. To ensure that we measure only the additional effect of ATRs on tax avoidance, we manually check the subsidiaries[45] of the U.S. firms in the years prior to and the year of the ATR. Excluding firms that first reported a Luxembourg subsidiary in the year of the ATR, we detect a similar significant effect in specification (2). As expected, we find evidence that U.S. firms, which are usually known for their aggressive tax planning, also exploit this tax avoidance structure and reduce their tax payments through ATRs in Luxembourg.

Specifications (3) to (5) compare non-U.S. firms to the just considered U.S. sample. Throughout all three specifications, the point estimate for RULING FIRM & PERIOD is negative and significant suggesting an increase in tax avoidance by more than 3 percentage points, which is consistent with the result in specification (1). An interaction term (RULING FIRM & PERIOD x NON-US) presents possible differences between the MNCs from different countries. We find no significant difference between the MNCs from different countries as the employed interaction term remains insignificant in specifications (3) to (5) of table 4. Neither the EU as a whole nor firms from large economies (Germany and United Kingdom) exhibit significant differences. The results are consistent with our expectation that firms headquartered in the EU also take advantage of Luxembourg ATRs as method of tax avoidance. The results indicate that MNCs benefit from ATRs in all subsamples irrespective of the corresponding headquarter location, suggesting that the decision to employ an ATR is not influenced by the home country tax system. Results in table A5 of the appendix are in line with this suggestion as they show no significant difference between countries who employ the worldwide tax system

[45] Subsidiary information is taken from Exhibit 21 of form 10-k, available at http://www.sec.gov/edgar/searchedgar/companysearch.html.

and countries employing the territorial tax system.[46] The varying tax planning opportunities seem to have no influence with regard to the effectiveness of ATRs.

3.4.3 Long-Term Effect of Advance Tax Rulings

So far, we have identified a short-term effect of ATRs on tax payments of MNCs. If we consider more than one post-ruling year, clear identification of an effect of ATRs becomes more difficult. Similar to event study analyses, other unobserved events or even additional tax planning activities of the firms included in our control group could affect the analyzed tax avoidance measures. Furthermore, MNCs change over time. Consequently, the structure assured by the ATR may no longer achieve the optimum or MNCs are no longer able to effectively employ the set structure. However, intuitively, one would expect ATRs to last for several years. Thus, considering that it is not absolutely clear for how long an ATR might affect the firm's ETR, we modify our original model as described in section 3.3.3 by using ceteris paribus two alternative long-term definitions of the variable RULING FIRM & PERIOD.

We repeat the analysis as shown in specification (3) of table 3 for the respective alterations and the sample derived in section 3.3.1. None of the modifications change the number of ruling firms in our treatment group. The results of the additional analyses are reported in table 5. In specifications (1) and (2), we expand our previous short-term definition, which sets RULING FIRM & PERIOD equal to 1 for the year after the first ATR. In specification (1), we include the year in which the ATR was signed as there may be already a slight effect immediately after the request was signed by fiscal authorities as well as the third year. It tests if the ATR is effective within three years. Consistent with our hypothesis, the coefficient of RULING FIRM & PERIOD is negative and significant. Inferences as well as the point estimator (-0.0187) decrease in absolute values compared to our short-term result in specification (3) of table 3. Nevertheless, the result shows that all ruling firms reached tax

[46] We consider the in our sample represented countries if they apply the same tax system throughout the observed time period.

payments over a three-year period that are on average 1.9 percentage points lower than those of firms that did not employ ATRs.

In specification (2), we propose an even longer effect of ATRs on tax avoidance. The dummy variable RULING FIRM & PERIOD is set to 1 for all years after the respective ATR. The point estimate for the variable of interest is negative but statistically insignificant. An interesting question is whether this concerns all MNCs or if some firms might actually benefit for a long period of time. In specifications (3) to (8), we therefore execute some cross-sectional sample splits.

Most ATRs in our sample have been issued during the financial crisis. During these times, financial firms were more likely to suffer profit setbacks which could explain a lower ETR. For the same reason, they might have needed ATRs only for means of tax certainty. Consequently, we expect no long-term effect on the ETR. Consistent with that expectation, we find a negative and significant point estimator (-0.0300) only for non-financial firms in specification (4) of table 5. In specifications (5) and (6), we analyze subsamples of non-financial firms by considering business-to-consumer (B2C) and business-to-business (B2B) firms.[47] We identify a long-term reduction of ETRs for B2C firms of more than 5 percentage points (-0.0512).

[47] Industries are based on the Fama and French 17 industries classification, where B2C includes industries 1 (food), 4 (textiles, apparel, and footware), 5 (consumer durables), 7 (drugs, soap, perfums, and tobacco), 12 (automobiles), and 15 (retail stores), and B2B industries 2 (mining and minerals), 3 (oil and petroleum products), 6 (chemicals), 8 (construction and construction materials), 9 (steel works), 10 (fabricated products), 11 (machinery and business equipment), 13 (transportation), and 14 (utilities).

Table 5. Potential Long-Term Effect of ATRs

Dependent Variable: GAAP ETR	3 years	long-term	financial	non-financial	B2C	B2B	capital intensive	non-cap. intensive
	1	2	3	4	5	6	7	8
RULING FIRM & PERIOD	-0.0187*	-0.0162	0.0202	-0.0300**	-0.0512**	0.0138	-0.0399***	0.0111
	(0.0098)	(0.0108)	(0.0188)	(0.0124)	(0.0200)	(0.0172)	(0.0112)	(0.0191)
SIZE	0.0142***	0.0142***	0.0083	0.0148***	0.0127**	0.0183***	0.0173***	0.0132***
	(0.0031)	(0.0031)	(0.0073)	(0.0034)	(0.0060)	(0.0058)	(0.0045)	(0.0042)
ROA	-0.0584***	-0.0584***	-0.2450***	-0.0526***	-0.0358*	-0.0487	-0.0443**	-0.0775**
	(0.0196)	(0.0196)	(0.0587)	(0.0184)	(0.0188)	(0.0308)	(0.0222)	(0.0316)
CAPINT	0.0273**	0.0273**	0.0923	0.0258**	0.0005	0.0480***	0.0459***	0.0168
	(0.0124)	(0.0124)	(0.0829)	(0.0125)	(0.0244)	(0.0180)	(0.0141)	(0.0282)
LEV	0.0755***	0.0753***	0.0351	0.0857***	0.0985**	0.1150***	0.0930***	0.0625**
	(0.0195)	(0.0195)	(0.0466)	(0.0212)	(0.0420)	(0.0350)	(0.0289)	(0.0261)
RD	-0.0355	-0.0357	0.4070*	-0.0423	-0.0655	-0.1060	-0.0514	-0.0220
	(0.0702)	(0.0702)	(0.2130)	(0.0708)	(0.1850)	(0.1100)	(0.0921)	(0.1040)
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓	✓	✓
N	35,399	35,399	4,160	31,239	7,420	12,063	18,556	16,843
Ruling Firms	136	136	46	90	31	28	63	73
Adj. R^2	0.435	0.435	0.570	0.410	0.458	0.387	0.403	0.461

Notes: Table 5 presents the results of full sample and cross-sectional OLS regressions with GAAP ETR as dependent variable and long-term definitions of RULING FIRM & PERIOD. Specifications (1) and (2) employ the full sample and expand the period in which the ATR affects the MNC's ETR. Specification (1) shows the three-year effect including the year of the first ATR. Specification (2) additionally includes all following years. Specifications (3) to (8) present cross-sectional sample splits to further explore the long-term effect as proposed in specification (2). Industries are based on the Fama and French 17 industries classification, where B2C includes industries 1, 4, 5, 7, 12, and 15, and B2B industries 2, 3, 6, 8 to 11, 13, and 14. Specifications (7) and (8) are formed based on the mean value of CAPINT. Thus, capital intensive firms are firms with CAPINT>0.31. Robust standard errors clustered by firms are shown in parentheses. The constant is not reported. FE are fixed effects. Variables are defined in table A1 of the appendix. *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

Usually, MNCs with mobile income are able to shift income and thus, avoid taxes more easily. In specifications (7) and (8), we differentiate MNCs according to their level of capital intensity. We consider a firm as capital intensive if the value of CAPINT is above the mean of all ruling firms (0.31). Interestingly, we find a long-term reduction of ETRs of 4 percentage points only for capital intensive firms (-0.0399). This implies that ATRs might have been used especially by MNCs that do not have the chance of tax avoidance under normal circumstances.

Overall, our results suggest that ATRs are in fact effective for three years. Certain MNCs, surprisingly those that are usually expected to engage in less tax avoidance, achieve an even longer effect. Even though we show some support for a long-term effect (three years) of about 2 percentage points, we might still underestimate the effect of ATRs. Its true magnitude and length may be even bigger, because we cannot guarantee that the control group does not include firms that have also signed an ATR in Luxembourg or somewhere else.

3.4.4 Matched-Sample Analysis

A restriction to our standard empirical model might be the potential endogeneity of a firm's status as ruling firm. As presented in equation (1), we expect that if a firm decides to get an ATR, the ATR will influence the firm's tax avoidance. Admittedly, the MNC's existing tax avoidance strategy might as well influence the decision to become a ruling firm. Having noticed that possibly only tax aggressive firms request an ATR, we account for this potential self-selection bias in a matched-sample analysis.

Propensity score matching is a feasible technique to address the potential bias caused by selection on observables (Caliendo and Kopeinig, 2008; Titus, 2007).[48] Its notion is to select a control group (non-ruling firms) that is as similar to the treatment group (ruling firms) as

[48] The self-selection bias has been discussed extensively in prior research (e.g. Tucker, 2010). Many studies implement either an instrumental variable or apply the two-step Heckman procedure using Inverse Mill's Ratio (Dwenger and Steiner, 2012; Badertscher, Katz, and Rego, 2013). Basically, both methods require an instrument, which explains the potentially endogenous variable, but has no effect on the dependent variable. This requirement equals the major limitation as it is difficult to have a consistent estimator, i.e., a variable that neither correlates with the outcome nor with any unobservables (Heckman, 1997; Blundell and Costa Dias, 2000; Heckman and Li, 2004).

possible. For the selection, we employ firm characteristics that are commonly known to describe a MNC's tendency towards tax avoidance. Results of two-sample t-tests of the employed variables are shown in table A6 of the appendix. They indicate mostly highly significant differences between treatment and control group. Solely the tests for ROA and CAPINT fall just short of being significant. However, generating two almost identical groups via matching, we expect them to have or rather develop the same tax planning behavior. Consequently, ruling firms are not more tax aggressive than non-ruling firms. The only difference between the groups lies in the treatment decision, i.e., engaging in an ATR or not. Since the assumption is to have two equally tax aggressive groups, the results show the effect of ATRs on tax avoidance.

However, as propensity score matching selects the control group based on observable variables only, omitted variables may negatively influence the matching quality and subsequently our result. To mitigate this problem, we combine propensity score matching with a difference-in-differences approach, because the latter accounts for time-invariant unobservables (Caliendo and Kopeinig, 2008; Heckman, Ichimura, Smith, and Todd, 1998), which in our setting, may be the tax advisor or the executive's preference regarding tax certainty. Thus, we select a control group, which is as similar as possible to our ruling firms, via propensity score matching. Then, we apply difference-in-differences on the newly matched sample to estimate the effect of ATRs on tax avoidance of MNCs.

With respect to propensity score matching, we further decrease our original sample by imposing another prerequisite. As we match in the year prior to the ATR and compare that year's ETR with the ETR the year after the ATR, we require available observations in those two years. This restricts our treatment group to 70 ruling firms, however, we are left with a balanced panel for the subsequent difference-in-differences analysis.

According to Rosenbaum and Rubin (1983), the first step of propensity score matching involves a probit model to estimate the propensity score, i.e., the probability of becoming a

ruling firm. In the matching sample, all ATRs as well as mergers and acquisitions took place between 2003 and 2011. As we match based on the year before, we estimate the propensity score for the years 2002 to 2010. We include the previously used and discussed determinants of tax avoidance in the probit regression. Additionally, we include an indicator of income mobile industries.[49] The regression results (cf. table A7 of the appendix) show the influence of the different firm characteristics on the propensity score and thus, the likelihood of being a ruling firm. It seems that mainly large and profitable firms engage in ATRs.[50]

In the second step, we apply one-to-five nearest neighbor matching and thus, match each ruling firm to a maximum of five non-ruling firms depending on how many suitable neighbors can be found. The match occurs based on the propensity score derived in the first step in the year directly preceding the ATR. We require a difference in propensity scores of less than 0.02.[51] Further, we ensure that only observations from the same year as well as only firms headquartered in the same country will be matched.[52] The overall good matching quality is verified in table 6. Comparing the means of the matching variables between ruling and non-ruling firms before and after the matching, it shows that for most characteristics the bias has been drastically reduced.

[49] We use SIC codes to compute the variable (De Simone, Mills, and Stomberg, 2014) and classify the following three-digit SIC codes as income mobile industries: 283 (Pharmaceutical), 357, 367, 737 (Computers) and 738 (Services).

[50] In table A8 of the appendix, we repeated our subsequent one-to-five nearest neighbor matched-sample analysis with a focus on large and profitable firms by additionally including the squares of SIZE and ROA in the propensity score. Results are similar to the ones reported in table 7 (significant estimator of 0.030), matching quality, however, decreases.

[51] According to Austin (2011), the optimal caliper width lies at 20 % of the standard deviation of the propensity score and calipers equal to 0.02 or 0.03 show superior performance. Following Lunt (2014) who states that the caliper should not be too low in order to avoid additional selection bias by drastically reducing the available control group, we set the width to 0.02. However, further results in table A8 of the appendix based on the chosen one-to-five nearest neighbor matching are robust to applying no caliper or widths of 0.01 (20 % of the standard deviation) and 0.03.

[52] Additional tests (cf. table A8 of the appendix), in which we only ensure same-year observations or additionally ensure that firms from the same industry are matched, provide results that are roughly consistent with the reported results in table 7. However, changing the propensity score decreases matching quality and thus, results do not as well mitigate the potential bias.

Table 6. One-to-Five Nearest Neighbor Matching Quality

Nearest Neighbor 1:5		Mean		Bias	Bias Reduction	t-test	
		Treated	Control	Bias		t	p>t
SIZE	Unmatched	9.7971	6.8743	144.4 %		12.22	0.000
	Matched	9.6690	9.6672	0.1 %	99.9 %	0.01	0.996
ROA	Unmatched	0.0877	0.1050	-15.9 %		-1.06	0.287
	Matched	0.0902	0.0892	0.9 %	94.3 %	0.08	0.939
CAPINT	Unmatched	0.3453	0.3595	-5.3 %		-0.45	0.654
	Matched	0.3551	0.3615	-2.4 %	55.4 %	-0.13	0.899
LEV	Unmatched	0.0626	0.0484	19.7 %		1.52	0.128
	Matched	0.0643	0.0653	-1.4 %	92.7 %	-0.07	0.942
INCOME MOBILE	Unmatched	0.1714	0.1774	-1.6 %		-0.13	0.896
	Matched	0.1765	0.1694	1.9 %	-18.7 %	0.11	0.914
RD	Unmatched	0.0157	0.0215	-15.2 %		-1.13	0.258
	Matched	0.0161	0.0161	0.0 %	99.8 %	0.00	0.998

Notes: Table 6 compares the means of the relevant matching characteristics between ruling and non-ruling firms before and after the matching. The control group is determined by the propensity score in the year prior to the ATR. The results are formed on one-to-five nearest neighbor matching requiring a difference in propensity score of less than 0.02. Variables are defined in table A1 of the appendix.

Via propensity score matching, we find a total of 303 matching partners for the 70 ruling firms. In our next step, we test the effect of ATRs in this setting. Table 7 presents the difference-in-differences results with robust standard errors clustered by firms. The first row represents the one-to-five nearest neighbor matching with GAAP ETR as dependent variable. The column 'Baseline' compares the ETRs of ruling and non-ruling firms in the matching year. We do not find a significant difference. This is consistent with our assumption that matched ruling and non-ruling firms are equally tax aggressive prior to the ATR and consequently, the possible self-selection bias is mitigated. The column 'Follow Up' presents the difference between the two groups in the year after the ATR. The point estimate (-0.043) indicates that ruling firms have significantly smaller ETRs after the ruling than non-ruling firms. The last column describes the actual difference-in-differences estimator, which is negative and significant. The coefficient (-0.034) suggests a decline of the ETR by about 3.4 percentage points if an ATR was signed. The result is consistent with findings in our prior analyses and with our hypothesis.

To assure that our result is not based on the chosen matching algorithm, we additionally test one-to-one nearest neighbor matching, which results in a significant coefficient of -0.053,

and kernel matching, which gives us a much bigger sample size (21,655 observations in the control group) as it uses weighted averages of the control firms. Kernel matching also yields a similar, negative, and significant result (-0.024).

Table 7. Difference-in-Differences Results after Matching

GAAP ETR	Baseline			Follow Up			Diff-in-Diff
	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	
1:5 NN	0.271	0.262	-0.008	0.277	0.234	-0.043***	-0.034**
			(0.015)			(0.014)	(0.014)
1:1 NN	0.268	0.262	-0.006	0.294	0.234	-0.060***	-0.053**
			(0.021)			(0.022)	(0.021)
Kernel	0.282	0.262	-0.020	0.278	0.234	-0.044***	-0.024**
			(0.013)			(0.011)	(0.012)

Notes: Table 7 presents difference-in-differences (Diff-in-Diff) results after one-to-five, one-to-one nearest neighbor, and kernel matching by showing the mean outcome (GAAP ETR as defined in table A1 of the appendix) for the treated and control group before and after the ATR as well as its difference. The treatment group includes 70 observations and the control group 303, 68, and 21,655 respectively. 'Baseline' refers to the year preceding the ATR and 'Follow Up' to the year directly following the ATR. Robust standard errors clustered by firms are shown in parentheses. *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

Moreover, the results are robust to alternative tax avoidance measures as respective results in table A8 of the appendix show similar, significant coefficients for CASH ETR. Applying FOREIGN ETR or limiting the GAAP ETR sample to U.S. firms results in very few left treatment observations and thus, insignificant difference-in-differences estimators.

3.5 Conclusion

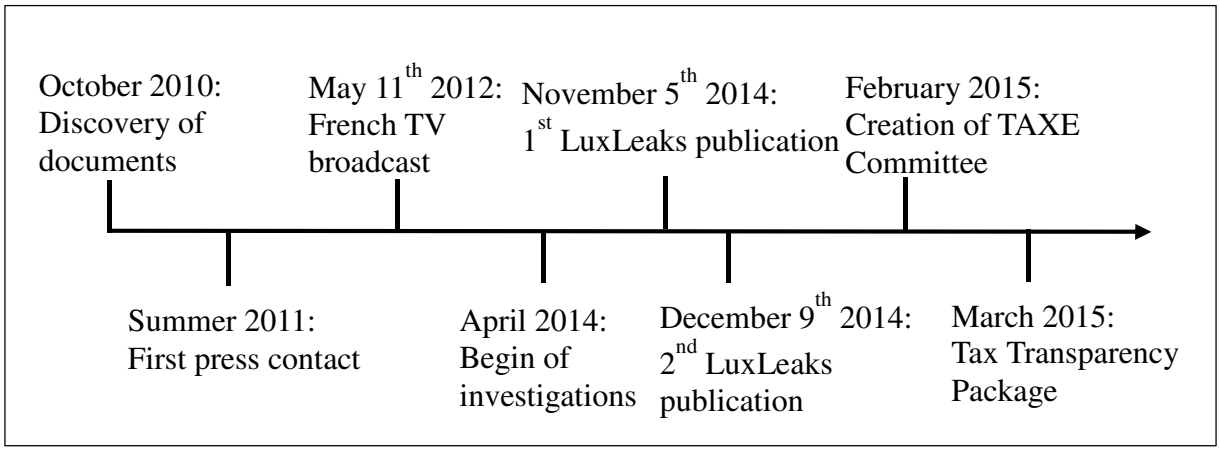
Tax avoidance has been discussed extensively in prior research. Contrariwise, tax avoidance through ATRs is widely unexplored. Recently, the ICIJ has attracted notice to ATRs by releasing hundreds of secret tax deals with Luxembourg tax authorities. The European Commission launched a 'Tax Transparency Package' and the OECD initiative against BEPS addressed ATRs in its final reports. In line with the public criticism of LuxLeaks and a certain type of ATRs, we expect that MNCs can enhance their tax avoidance by engaging in an ATR.

Using fixed effects panel regressions, we examine the reduction in ETRs that ruling firms experience after their respective ATR compared to non-ruling firms. The LuxLeaks data provides us with the necessary information about firms imvolved in ATRs. Imposing our data

requirements, we finally include the data of 136 ruling firms. Our empirical analysis shows that the additional effect of ATRs in Luxembourg on the multinationals' ETRs consists of a decline by about 4 percentage points. The result might be biased due to possible endogeneity. To mitigate this limitation, we perform a matched-sample analysis which yields consistent results. The identified short-term effect may, nevertheless, be a minimum effect as we may underestimate its impact due to a slightly imperfect control group. That means the true magnitude and length of the effect of ATRs on tax avoidance may be even more pronounced. Additional analyses suggest that after three years, the effect still amounts to almost 2 percentage points. A longer effect can, however, only be identified for business-to-consumer and capital intensive firms. Nevertheless, the significant reduction implies that MNCs avoid taxes through ATRs and thus, exploit the legally assured tax structures. Moreover, the results hint at a distortion of competition as Luxembourg acts as tax haven through administrative practices for selected MNCs. Our findings are robust to different firm-level control variables and diverse robustness tests. Consequently, we conclude that MNCs use ATRs in tax havens as a method of tax avoidance. Although our results consider the unique case of LuxLeaks, policymakers should be generally aware that some MNCs together with fiscal authorities exploit ATRs to drastically reduce their tax payments.

Appendix

Figure A1. Timeline of Events Associated with LuxLeaks



Notes: Figure A1 shows a timeline with events that are associated with LuxLeaks. The actual revelation of documents took place on November 5th and December 9th 2014.

Table A1. Variable Definitions

Tax Avoidance Measures	
GAAP ETR	*txt / (pi – xi)*, i.e., income taxes divided by pretax income, adjusted for extraordinary items (set to 0 if missing); exclude outliers
CASH ETR	*txpd* / *pi*, i.e., income taxes paid divided by pretax income; exclude outliers
FOREIGN ETR	*txfo* / *pifo*, i.e., foreign income taxes divided by foreign pretax income; exclude outliers
Determinants of Tax Avoidance	
SIZE	log (*at*), i.e., logarithm of total assets
ROA (Return on Assets)	*pi* / *at*, i.e., pretax income divided by total assets
CAPINT (Capital Intensity)	*ppegt* / *at*, i.e., total property, plant, and equipment divided by total assets; exclude CAPINT>1
LEV (Leverage)	*dlc* / *at*, i.e., debt in current liabilities divided by total assets; exclude LEV>1
RD (Research & Development)	*xrd* / *at*, i.e., research and development expense divided by total assets (set to 0 if missing *xrd*)
NOL (Net Operating Loss)	Indicator variable equal to 1 if tax-loss carryforward (*tlcf*) at the end of the previous year is bigger than current *tlcf*
Identifier of Ruling Firms	
RULING FIRM	Dummy, which is 1 if ATRs of the company were published by ICIJ, and 0 otherwise
RULING FIRM & PERIOD	Dummy, which equals 1 if the ATR of that ruling firm is expected to be effective in that year

Notes: Table A1 shows variable definitions. Firm data is taken from *Compustat North America* and *Compustat Global*. *Compustat* data items are in italic.

Table A2. Data Development

Description	All Firms		Treatment Group	
	Firms	Firm-Years	Firms	Firm-Years
ICIJ Ruling Firms	-	-	345	-
Available in Databases	-	-	164	-
Observed Time Period	60,452	564,563	162	2,197
Available Ruling Document	60,450	564,533	160	2,167
Delete Japanese Firms	56,034	515,905	158	2,142
Delete Negative Pretax Income	44,584	334,973	156	1,816
Non-Missing GAAP ETR	43,282	306,364	156	1,714
Delete Outliers	43,071	301,484	156	1,683
Non-Missing Control Variables	37,105	226,819	136	1,327
MNCs from Treated Countries	5,774	35,399	136	1,327
Exclude first year of ATR	5,774	35,312	136	1,240

Notes: Table A2 plots the data development of the whole sample as well as of the treatment group, i.e., ruling firms. Variables are defined in table A1 of the appendix.

Table A3. Correlation Matrix

Variable	GAAP ETR	CASH ETR	FOREIGN ETR	RULING FIRM	RULING PERIOD	SIZE	ROA	CAPINT	LEV	RD	NOL	Industry
GAAP ETR	1.0000											
CASH ETR	0.3635	1.0000										
FOREIGN ETR	0.2975	0.2494	1.0000									
RULING FIRM	-0.0346	-0.0027	-0.0030	1.0000								
RULING PERIOD	-0.0321	-0.0077	-0.0096	0.2857	1.0000							
SIZE	-0.0629	0.0027	-0.0551	0.2083	0.0756	1.0000						
ROA	-0.0393	-0.0628	-0.0550	-0.0069	-0.0084	-0.0709	1.0000					
CAPINT	0.0281	0.0405	0.0409	-0.0198	-0.0141	0.0270	0.0171	1.0000				
LEV	0.0086	0.0261	0.0154	0.0985	0.0130	0.2072	-0.0610	-0.0453	1.0000			
RD	-0.1968	-0.1697	-0.1107	-0.0448	-0.0133	-0.2209	0.0411	-0.1566	-0.1190	1.0000		
NOL	-0.0426	-0.0927	-0.0524	-0.0060	0.0007	-0.0285	-0.0042	-0.0311	-0.0334	0.0673	1.0000	
Industry	0.0060	-0.0423	0.0324	-0.0073	0.0079	-0.0699	-0.0462	-0.2690	-0.0259	0.1297	0.0000	1.0000

Notes: Table A3 shows a correlation matrix of all variables included in the main regression analyses as well as the additionally employed measures of tax avoidance. Furthermore, we include NOL in the matrix as an important variable for the U.S. subsample. Variables are defined in table A1 of the appendix.

Table A4. Robustness Tests to Main Analysis

Dependent Variable: GAAP ETR	Standard Errors		Additional Controls			Late ATR	Re-estimation
	1	2	3	4	5	6	7
RULING FIRM & PERIOD	-0.0468***	-0.0403**	-0.0397***	-0.0324***	-0.0285***	-0.0418***	-0.0304*
	(0.0107)	(0.0148)	(0.0119)	(0.0107)	(0.0108)	(0.0114)	(0.0167)
RULING FIRM	-0.0068						
	(0.0110)						
SIZE	0.0056***	0.0144***	-0.0055***	0.0056	0.0612***	0.0146***	-0.0007
	(0.0012)	(0.0029)	(0.0008)	(0.0040)	(0.0110)	(0.0031)	(0.0050)
ROA	-0.0297***	-0.0582**	-0.0246**	-0.1330**	-0.2650***	-0.0580***	-0.1250***
	(0.0058)	(0.0243)	(0.0106)	(0.0526)	(0.0229)	(0.0196)	(0.0239)
CAPINT	0.0148	0.0283**	0.0160***	0.0423**	-0.0032	0.0280**	-0.0035
	(0.0168)	(0.0112)	(0.0059)	(0.0169)	(0.0445)	(0.0124)	(0.0210)
LEV	-0.0825*	0.0748***	0.0302*	0.0898***	0.0462	0.0754***	0.0600**
	(0.0459)	(0.0185)	(0.0180)	(0.0237)	(0.0391)	(0.0195)	(0.0281)
RD	-0.1680***	-0.0356	-0.3320***	-0.0306	0.1640	-0.0379	0.0267
	(0.0520)	(0.0437)	(0.0325)	(0.0874)	(0.1020)	(0.0701)	(0.1250)
INCOME MOBILE			-0.0151***				
			(0.0039)				
INTANGIBLES			0.0677***	0.0188	0.0361		
			(0.0076)	(0.0168)	(0.0343)		
SALES GROWTH			-0.0006***	-0.0001	-0.0003		
			(0.0001)	(0.0004)	(0.0021)		
STATUTORY TAX RATE			0.3340***	0.1070	0.6300		
			(0.0187)	(0.0743)	(0.5030)		
Polynomials					✓		
Year FE	✓	✓	✓	✓	✓	✓	✓
Industry FE	✓		✓				
Firm FE		✓		✓	✓	✓	✓
N	35,312	35,312	25,893	25,893	25,893	35,138	11,815
Ruling Firms	136	136	102	102	102	119	26
Adj. R^2	0.042	0.436	0.084	0.381	0.389	0.437	0.404

Notes: Table A4 shows the results of several robustness tests to our main analyses in table 3. Specifications (1) and (2) employ standard errors clustered by industry. In specifications (3) to (5), we include additional controls. Specification (6) performs the regression for a subsample of ruling firms that have signed their ATR in either 2009 or 2010. Specification (7) re-estimates the FOREIGN ETR subsample with GAAP ETR as dependent variable. Robust standard errors clustered by firms are shown in parentheses, except for specifications (1) and (2). INCOME MOBILE is a dummy for pharmaceuticals, computers, and services. INTANGIBLES is defined as intangible assets over total assets. SALES GROWTH is the increase in net turnover divided by last year's turnover. STATUTORY TAX RATE is the country's corporate tax rate as found in the worldwide tax summaries of PwC, KPMG, and EY. Polynomials include the squares of all other variables in the regression. Other variables are defined in table A1 of the appendix. The constant is not reported. FE are fixed effects. *, ** and *** show significance at the level of 10 %, 5 % and 1 %, respectively.

Table A5. Worldwide versus Territorial Tax System

Variable	GAAP ETR	
	1	2
RULING FIRM & PERIOD	-0.0426***	-0.0540***
	(0.0148)	(0.0198)
RULING FIRM & PERIOD x WOLRDWIDE	0.0056	0.0146
	(0.0209)	(0.0247)
SIZE	0.0147***	0.0130***
	(0.0031)	(0.00334)
ROA	-0.0579***	-0.0472***
	(0.0196)	(0.0162)
CAPINT	0.0278**	0.0243*
	(0.0124)	(0.0129)
LEV	0.0768***	0.0702***
	(0.0195)	(0.0211)
RD	-0.0424	-0.0154
	(0.0699)	(0.0808)
Year FE	✓	✓
Firm FE	✓	✓
N	35,060	29,295
Ruling Firms	135	111
Adj. R^2	0.432	0.446

Notes: Table A4 analyzes the effect of ATRs on MNCs headquartered in a country applying the worldwide tax system versus the territorial tax system. Specification (2) excludes the countries which switch their tax system in the sample period. Variables are defined in table A1 of the appendix. Robust standard errors clustered by firms are shown in parentheses. The constant is not reported. FE are firm fixed effects. *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

Table A6. Two-Sample T-Tests before Matching Procedure

Variable	Non-Ruling Firms		Ruling Firms		Two-Sample T-Test	
	Mean	Std. err.	Mean	Std. err.	Difference	Std. err.
SIZE	6.7123	0.0134	9.9379	0.0902	-3.2256***	0.0839
ROA	0.1095	0.0035	0.0853	0.0032	0.0242	0.0216
CAPINT	0.3486	0.0018	0.3332	0.0114	0.0154	0.0115
LEV	0.0482	0.0005	0.0595	0.0028	-0.0113***	0.0033
INCOME MOBILE	0.1826	0.0025	0.1483	0.0141	0.0344**	0.0155
RD	0.0223	0.0003	0.0137	0.0011	0.0086***	0.0019

Notes: Table A6 shows the results of two-sample t-tests before the matching to identify differences between ruling and non-ruling firms. Variables are defined in table A1 of the appendix. *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

Table A7. Probit Regression Results

Dependent Variable: RULING FIRM	
SIZE	0.294***
	(0.011)
ROA	0.121***
	(0.040)
CAPINT	0.209***
	(0.075)
LEV	-0.389
	(0.282)
INCOME MOBILE	0.275***
	(0.066)
RD	-1.583**
	(0.746)

Notes: Table A7 presents the probit regression results used for the prediction of our propensity score. Dependent variable is a dummy variable which is defined as 1 for ruling firms. Variables are defined in table A1 of the appendix. *, ** and *** show significance at the level of 10 %, 5 % and 1 %, respectively.

Table A8. Robustness Tests to Diff-in-Diff after Matching

Nearest	Baseline			Follow Up			Diff-in-
Neighbor 1:5	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	Diff
Large and	0.269	0.262	-0.007	0.272	0.234	-0.037***	-0.030**
Profitable			(0.015)			(0.014)	(0.014)
No Caliper	0.273	0.262	-0.011	0.276	0.234	-0.042***	-0.031**
			(0.015)			(0.014)	(0.014)
Caliper of 0.01	0.269	0.262	-0.007	0.274	0.234	-0.039***	-0.032**
			(0.015)			(0.014)	(0.014)
Caliper of 0.03	0.270	0.262	-0.008	0.276	0.234	-0.042***	-0.033**
			(0.015)			(0.014)	(0.014)
Same Year	0.271	0.262	-0.009	0.276	0.234	-0.042***	-0.033**
Only			(0.015)			(0.014)	(0.014)
Same Industry	0.295	0.262	-0.033*	0.278	0.234	-0.044***	-0.010
			(0.017)			(0.015)	(0.015)
CASH ETR	0.233	0.272	0.038*	0.250	0.233	-0.017	-0.055***
			(0.022)			(0.023)	(0.028)
FOREIGN	0.284	0.261	-0.023	0.290	0.260	-0.031	-0.008
ETR			(0.036)			(0.040)	(0.044)
U.S. Sample	0.306	0.261	-0.044**	0.305	0.232	-0.073***	-0.029
			(0.019)			(0.021)	(0.020)

Notes: Table A8 presents difference-in-differences (Diff-in-Diff) results after one-to-five nearest neighbor matching by showing the mean outcome for the treated and control group before and after the ATR as well as its difference. The different rows represent robustness tests to the results presented in table 7. Group size as well as matching quality vary to the main analyses. Robust standard errors clustered by firms are shown in parentheses. Variables are defined in table A1 of the appendix. *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

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Chapter 4

Effects of Disclosing Tax Avoidance: Capital Market Reaction to LuxLeaks

Effects of Disclosing Tax Avoidance:

Capital Market Reaction to LuxLeaks

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Abstract:

This study analyzes the capital market reaction to news about tax avoidance. As tax information is usually not published, little is known about the effects of disclosing tax avoidance. However, in the course of the event known as LuxLeaks, hundreds of tax documents were released. Unlike other events used in previous literature, the litigation risk, which is generally associated with tax avoidance, is considerably lower because these documents consist of advance tax rulings. Using an event study methodology, we find weak evidence for positive cumulated abnormal returns for the involved firms. Our results cast doubts on significant reputational effects and suggest that market participants reward unintended disclosure of tax avoidance. Further analysis suggests that the capital market especially rewards news about a firm's additional engagement in tax avoidance that is associated with a low risk of litigation.

Keywords: Market Reaction, Tax Avoidance, Disclosure, Litigation Risk, Reputational Costs

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4.1 Introduction

On November 5, 2014, the International Consortium of Investigative Journalists (ICIJ) published information about hundreds of advance tax rulings (ATRs) regarding multinational corporations (MNCs). This unexpected dissemination of confidential tax documents was publicly dubbed Luxembourg Leaks (LuxLeaks). Several years prior to the leak, the MNCs had signed private tax deals in the form of ATRs with the Luxembourg fiscal authority. As ATRs are usually not disclosed, the revelation provided new information to the capital market. Thus, this event offers a rare opportunity to scrutinize the capital market reaction to disclosure of tax avoidance.

The unintended disclosure caused by the leak provides highly credible and realistic information of tax structures as MNCs had no chance of modifying the data. Consequently, having reliable information about tax avoidance, firm value should increase as tax avoidance is associated with additional after-tax profits. Nevertheless, tension is given as survey evidence suggests that managers who are often risk averse fear the risks of tax litigations as well as negative media coverage or even customer boycotts if details of tax avoidance strategies are available (Graham, Hanlon, Shevlin, and Shroff, 2014). For this reason, voluntary disclosure is very scarce and the ATRs have not been disclosed in advance to the leak.

Policymakers and the Organization for Economic Cooperation and Development (OECD) recently try to increase tax transparency, whereas investors disapprove of this development. Yet, as so far only few tax information has been made public, little is known about the effects of disclosing tax avoidance details, irrespective of the form of disclosure. Prior literature provides some limited evidence on a negative effect of unintentionally disclosing particular tax avoidance structures. Hanlon and Slemrod (2009) as well as Gallemore, Maydew, and Thornock (2014) find weakly negative capital market reactions to the detection of tax shelters – an extremely aggressive form of tax avoidance associated with additional taxes and penalties.

Using the unique setting of the event LuxLeaks, we analyze the capital market reaction to news about particular tax avoidance structures not accompanied by high litigation risks or additional taxes. The disclosed tax avoidance structures are perfectly legal and provide tax certainty because all involved MNCs had signed ATRs. We apply an event study methodology to identify the capital market response to the unintended disclosure of tax avoidance structures. The LuxLeaks publications provide a large sample of hundreds of firms, all revealed as having engaged in tax planning structures like hybrid finance or transfer pricing associated with intellectual property (ICIJ 2014a/2014b). The high number of firms made tax planning behavior a particularly salient issue once the revelation was announced. Moreover, all firms were revealed on the same date. Therefore, media coverage was substantially higher than for a compilation of firms revealed on very different dates.

Considering each MNC's share prices around the particular event day (November 5, 2014) and the development of its respective market, we calculate the cumulated abnormal returns. Thereby, we are able to show some evidence for a positive capital market reaction, i.e., a positive net effect on firm value. LuxLeaks firms achieved a return that was, on average, 1.22 percentage points higher than the market. Our results suggest that possible reputational losses do not outweigh positive effects and that market participants reward credible information about sophisticated tax avoidance. Considering this result, unintended disclosure of tax planning with a low level of litigation risks, which changes the shareholders' expectation, is certainly not detrimental and may even be beneficial for corporations.

In additional tests, we find weak evidence for a more pronounced positive capital market reaction to LuxLeaks for firms with extraordinarily low effective tax rates (ETRs) and robust evidence for firms with extraordinarily high ETRs. The latter finding is in line with the argument that the capital market rewards new information about a firm's commitment to tax avoidance, particularly if new information about involvement in tax planning is detected that had not already been disclosed by the fairly high ETR of these firms. The former finding is

consistent with the view that the capital market rewards information about tax certainty provided by an ATR for those MNCs that are perceived as particularly tax aggressive.

Our paper contributes to the existing literature in the following ways. First, we extend the available literature on the impact of tax avoidance on firm value. One strand of literature suggests a positive effect on firm value. A recent study by Goh, Lee, Lim, and Shevlin (2016) confirms lower cost of equity for tax avoiding firms. Yet, prior studies by Desai and Dharmapala (2009) and Wilson (2009) find significant, positive effects only for the presence of strong corporate governance. Moreover, a few studies find positive value effects of particular sources of tax avoidance (Bryant-Kutcher, Guenther, and Jackson, 2012; Inger, 2014). While these studies consider only general information about a firm's tax avoidance, another smaller strand of literature investigates the effects of unintentionally disclosing additional information about particular tax planning structures. Hanlon and Slemrod (2009) as well as Gallemore et al. (2014) analyze the capital market response to the dissemination of tax sheltering firms. Interestingly, they find insignificant or weakly negative effects on firm values. Furthermore, Hanlon and Slemrod (2009) find capital market losses only for tax sheltering firms with low ETRs, while for high-ETR firms, they find no negative capital market responses. Consequently, there is no mutual consent on the potential trend of disclosing additional information about tax avoidance on firm value.

One explanation for negative effects or unclear results in prior studies might be the fact that news about particular tax avoidance often includes information about tax sheltering or tax litigation. Literature shows that uncertainty about future tax payments or penalties might reverse the positive valuation (Inger, 2014; Jacob and Schütt, 2015; Drake, Lusch, and Stekelberg, 2017). The LuxLeaks publications, however, address ATRs that reduce the litigation risk. ATRs represent binding tax deals between fiscal authorities and firms whose tax consequences are also set out in the ruling (OECD, 2015). Due to these specific properties of ATRs, LuxLeaks is, to the best of our knowledge, the first event that provides information about

a sample of MNCs that engaged in tax avoidance with a low level of litigation risk. Thus, our study is the first to show that there is at least no negative or even a positive effect on firm value in a setting with low litigation risks. Additionally, we show that the positive effect is most pronounced for MNCs at the lowest level of tax aggressiveness. MNCs, as argued by Hanlon and Slemrod (2009), are rewarded for their commitment to tax planning beyond their mere disclosure of ETRs in their financial accounts.

Second, our results consequently contribute to the ongoing debate on tax transparency and disclosure. Currently, there is a lack of detail in disclosure which makes it difficult to assess the type of tax avoidance a MNC engages in. Aiming to improve transparency, policymakers worldwide are occupied with the OECD's project on base erosion and profit shifting (BEPS) and implementing a country-by-country reporting. Public scrutiny like this can lead to more disclosure (Dyreng, Hoopes, and Wilde, 2016). It is an interesting empirical task to identify the potential consequences for MNCs, as MNCs seem to dread regulatory changes regarding additional disclosure. Considering the Panama Papers, Omartian (2016) reveals that investors try to hinder increased transparency and Robinson and Schmidt (2013) find that investors reward low disclosure quality. However, we find no negative and some positive effects on firm value as the publicly available level of tax information, i.e., tax transparency, increases. Due to audits and regulations, mandatory disclosure provides a similarly credible and realistic picture as the investigated unintended disclosure. Thus, we cautiously infer from our results that it might – in contrast to previous belief – be beneficial for corporations if they are required to disclose further tax information.

Third, we contribute to the literature on reputational costs and their effect on firm value. Popular sentiment, mirrored by excessive media coverage of tax-related scandals, generally disapproves of firms apparently not paying their fair share of taxes. Accordingly, worldwide news, which described LuxLeaks as Luxembourg rubber-stamping tax avoidance and MNCs

cutting their tax bills[53], shaped a clearly negative image of the firms named by the ICIJ (ICIJ, 2014a). In line with this notion, a recent survey among managers of U.S. firms suggests that managers consider potential reputational effects if tax avoidance is perceived as too aggressive (Graham et al., 2014). Interestingly, prior event studies of tax revelations show that investors barely contemplate reputational effects and find no overall evidence of shareholders perceiving tax sheltering as a corporate misdeed (Hanlon and Slemrod, 2009; Gallemore et al., 2014).[54]

Generally, aggressive tax avoidance is also associated with risk, i.e., uncertainty about additional taxes and penalties (Dyreng, Hanlon, and Maydew, 2017; Hasan, Hoi, Wu, and Zhang, 2014). However, the through LuxLeaks revealed ATRs are accompanied by a substantially lower litigation risk. Consequently, any potentially negative capital market reaction must be attributed to negative effects other than additional taxes. This allows us to draw clearer conclusions with regard to reputational effects than prior literature. Nevertheless, our results also suggest that reputational effects are small. Finding no negative effects on firm value, we conclude that reputational damage does not outweigh the positive effects that tax avoidance exerts on firm value.

The remainder of the paper is organized as follows. In section 4.2, we describe the LuxLeaks event in detail and develop our hypotheses according to prior literature. Section 4.3 presents our data and research methodology. Empirical results are provided in section 4.4. Section 4.5 concludes.

[53] For example: *The Guardian* (2014, November 5), available at http://www.theguardian.com/business/2014/nov/05/-sp-luxembourg-tax-files-tax-avoidance-industrial-scale, and *The New York Times* (2014, November 6), available at http://www.nytimes.com/2014/11/07/world/europe/head-of-european-commission-under-pressure-over-luxembourg-tax-revelations.html?_r=4.

[54] An example is provided by Brooks, Godfrey, Hillenbrand, and Money (2016) who indicate that potential reputational losses do not even matter when a company's name is mentioned in the context of a tax-related scandal. The media outcry about Starbucks' drastically reduced ETR initially led to customer boycotts. However, within a short time, most customers returned and Starbucks' business is now flourishing. Thus, even in the case of seemingly bottomless tax avoidance, reputational damage occurs only temporarily.

4.2 Event and Hypotheses Development

4.2.1 Luxembourg Leaks

On November 5, 2014, the ICIJ released, on its website, information about hundreds of ATRs – "a feature in the international tax system" (Christians, 2014, p. 1123) – regarding MNCs (ICIJ, 2014a/2014b). As the documents contained private tax deals between MNCs and Luxembourg fiscal authorities, the event became publicly known as LuxLeaks.[55] In October 2010, a former employee of PricewaterhouseCoopers discovered the documents, which would only be released later. His contact with the press led to a French TV broadcast in May 2012. Afterwards, it took almost two more years until the ICIJ began its investigation and another seven months until the documents and the names of the respective firms were finally published online. As most incidents are not clearly identified, we cannot use them in our event study design. Furthermore, although these incidents spread rumors throughout the capital market, they did not explicitly name the involved corporations. Importantly, the rumor did not hint at a later release of all involved MNCs. The French TV broadcast named only two MNCs included in our sample: GlaxoSmithKline and Wendel. Considering their share prices as well as those of the French leading index CAC40, we find no abnormal movements in the stock charts.[56]

Following the leak on November 5, 2014, news reports quickly criticized Luxembourg who "rubber-stamped tax avoidance on an industrial scale"[57] and acted "as a haven for hundreds of companies seeking to drastically reduce their tax bills"[58]. Marian (2017, p. 202) analyzes how Luxembourg became "a tax-haven by administrative practice". In December 2014, a few

[55] Figure A1 of the appendix depicts the development prior to our event.
[56] On May 11th, 2012, the French TV channel France 2 showed a report titled "Paradis Fiscaux: les petits secrets des grandes entreprises" (Tax Havens: the little secrets of the big companies), in which they cover some of the applied structures involved in the LuxLeaks documents. As the TV show did not include a list of firm names, and as the show was broadcast in French, we do not anticipate a reaction by global capital markets.
[57] *The Guardian* (2014, November 5), available at http://www.theguardian.com/business/2014/nov/05/-sp-luxembourg-tax-files-tax-avoidance-industrial-scale.
[58] *The New York Times* (2014, November 6), available at http://www.nytimes.com/2014/11/07/world/europe/head-of-european-commission-under-pressure-over-luxembourg-tax-revelations.html?_r=4.

additional documents were made public. However, those represent only a small fraction of the total of 345 MNCs that were exposed.[59]

The published tax documents contain commonly used tax structures, such as hybrid financing or use of intellectual property (a detailed description of the tax structures is provided by Marian, 2017). In the case of LuxLeaks, they were accompanied by ATRs, which had already been implemented between 2002 and 2010. By definition, ATRs "are specific to an individual taxpayer and provide a determination of the tax consequences of a proposed transaction on which the particular taxpayer is entitled to rely" (OECD, 2015, p. 47). Therefore, the revealed structures are approved by fiscal authority and consequently, are associated with low litigation risks. The Luxembourg Ministry of Finance clarifies that ATRs are legal documents that comply with the law.[60] Thus, LuxLeaks released information about a sophisticated form of tax planning, i.e., legally assured tax avoidance, to the capital market. Put differently, the dissemination did not trigger additional taxes, as ATRs provide tax certainty. Hence, the event examined in this study captures the reaction to news about corporate tax avoidance, which will apparently persist in the future.

As Huesecken and Overesch (2015) confirm, MNCs achieved a significant reduction in their worldwide ETRs after they agreed on an ATR. ETRs are disclosed as part of the financial reporting of a firm and provide some general information about the firm's tax position. However, particular information about tax avoidance behavior is not disclosed. Moreover, Luxembourg does not disclose its issued ATRs to ensure financial privacy (Christians, 2014).

Interestingly, the corporations do not voluntarily disclose that information either. The absence of any voluntary disclosure suggests that managers do not expect that benefits of additional disclosure of ATRs outweigh potential costs and risks. One explanation might be ex

[59] On December 9, 2014, only eight firms were newly revealed and for some, already mentioned firms additional documents became available.
[60] *Luxembourg Government* (2014, November 7), available at http://www.gouvernement.lu/4160549/07-luxleaks-EN.

ante uncertainty of costs (and benefits) associated with tax disclosure. Although previous literature finds it difficult to establish clear evidence about reputational costs (Gallemore et al., 2014), the high media coverage of some tax planning structures causes particular reputational concerns. Moreover, voluntary disclosure of refined tax planning techniques might be perceived as boasting and thus, might be associated with exceptionally negative effects. Second, it is well-known that managers are risk averse. Accordingly, they might value reputational risks and information benefits asymmetrically. Therefore, risk averse managers did not voluntarily disclose details about tax avoidance structures.

Consequently, the revelation on November 5, 2014 provided the capital market with new information about the ATR usage of particular MNCs. We can therefore use this event - an unexpected dissemination of confidential tax documents - to capture capital market reactions to disclosure of tax avoidance.[61]

4.2.2 Development of Hypotheses Regarding the Effect of Disclosing Tax Avoidance

The LuxLeaks event provides a unique setting to analyze the capital market reaction to the disclosure of detailed tax planning structures. Shareholders' reactions are essential for firms (Penno and Simon, 1986). Consequently, corporations aim to fulfill shareholders' expectations, e.g. by increasing their earnings (Burgstahler and Dichev, 1997; Beatty, Ke, and Petroni, 2002). Taxes obviously influence corporations' earnings. Prior literature analyzes the market response to taxes and tax-related corporate decisions. Several studies investigate the influence of tax law changes (e.g., Ayers, Cloyd, and Robinson, 2002; Edwards and Shevlin, 2011). They find a decline in stock prices coinciding with the announcement of unfavorable tax laws. Their findings already suggest that less tax expenses are associated with higher firm value. Unlike

[61] A capital market reaction to a specific event can only be captured if the capital market does not anticipate the event (Doidge and Dyck, 2015) because investors only trade if they are provided with new information (Bauer and Klassen, 2017). Particularly changes in tax policies that allow or hinder tax planning are often widely anticipated. In contrast, we analyze the unexpected dissemination of confidential tax documents.

these studies, we do not investigate the effect of a fiscal reform but of the corporation's conscious decision to engage in tax avoidance.

Tax avoidance can increase firm value (Desai and Dharmapala, 2009; Wilson, 2009) and reduce cost of capital (Goh et al., 2016). Therefore, shareholders could reward any additional information about managers' commitment to tax avoidance because lower tax expenditures increase the financial resources available for distribution. For example, Bryant-Kutcher et al. (2012) find increased firm value in relation to decreased foreign taxes. Inger (2014) detects significant effects on firm values for tax avoidance associated with stock options. Similarly, Chyz, Leung, Li, and Rui (2013) show that abnormal returns decrease if labor unions are elected, as they usually reduce the firm's level of corporate tax avoidance. While these studies suggest a positive effect of information about tax avoidance on firm value, they could only consider the limited set of information about a firm's tax pattern that is usually disclosed. A working paper by Wang (2011), however, suggests that investors place a higher price premium on tax avoidance if a firm is more transparent. Consequently, additional disclosure of particular details of a firm's tax avoidance strategy might be associated with positive effects on firm value.

Moreover, the capital market wants "the company to be optimally aggressive" (Hanlon and Slemrod, 2009, p.126). Put differently, shareholders want managers to reduce corporate tax payments without an exorbitant risk of additional costs, such as tax litigation and additional taxes. Rego and Wilson (2012) state that appropriate risks are desired. Our study reveals whether corporations can capitalize tax avoidance if they effectively manage potential litigation risks by ATRs. Prior literature shows that if tax avoidance adds uncertainty, the positive effects of reduced tax payments might be reversed (Inger, 2014; Jacob and Schütt, 2015). Drake et al. (2017) point out explicitly that tax risk moderates the positive valuation. Frischmann, Shevlin, and Wilson (2008) show that initial positive effects of disclosing uncertain tax benefits were reversed upon a later Senate inquiry into FIN 48 disclosures. Blaufus, Möhlmann, and Schwäbe (2016) find positive capital market reactions to tax avoidance but negative reactions to illegal

tax evasion. Furthermore, prior literature finds that strong corporate governance can lead to a positive market response to tax sheltering as corporate governance reduces principal agent conflicts (Desai and Dharmapala, 2009; Wilson, 2009). Their findings suggest that the capital market also reacts particularly positive if costs and risk associated with tax avoidance are minimized.

Our study relates to the above-mentioned strands of literature because the tax structures and ATRs detected by LuxLeaks represent a firm's decision to engage in additional tax planning. Furthermore, the revelation of such planning - and its possible implications - embody an exogenous event, which should induce a capital market reaction. In contrast to previous studies, our setting includes an important additional feature. LuxLeaks provides news about a particular, more sophisticated tax avoidance strategy because the tax structures are always accompanied by an ATR. An ATR is an agreement between a tax authority and a taxpayer about the application of tax law in the context of a special arrangement. By definition, ATRs provide tax certainty as fiscal authorities have to comply with the consequences set out in the ATR (Givati, 2009; Diller, Kortebusch, Schneider, and Sureth, 2017; Hoke, 2015). The risk of future payments is reduced. Thus, an ATR not only helps implement structures to avoid taxes, it also lowers tax litigation risks.

We test the following hypothesis:

H1a. *The capital market reaction to LuxLeaks should be positive if shareholders reward disclosure of tax avoidance structures which are associated with low litigation risks.*

However, tax avoidance might as well have negative effects on firm value. In the matter of tax avoidance, MNC's strategies might be directly accompanied by penalties and additional taxes. Possibly for this reason, prior literature finds that investors do not favor tax transparency (Omartian, 2016; Robinson and Schmidt, 2013). Excessive tax avoidance may also be perceived as a firm's willingness to lie to its shareholders (Desai, Dyck, and Zingales, 2007) or may lead

to reputational consequences, such as consumers choosing to buy from the firm's competitors (Klein and Leffler, 1981) or increased scrutiny by fiscal and supra-governmental authorities.

Using an event study design, Hanlon and Slemrod (2009) and Gallemore et al. (2014) find weak evidence that news about tax shelter involvement, i.e., the most aggressive form of tax planning, yields capital market losses. Other studies reveal a potentially negative effect of tax avoidance on firm value (Kim, Li, and Zhang, 2011; Mironov, 2013; O'Donovan, Wagner, and Zeume, 2017). For example, Kim et al. (2011) identify an increase in stock price crash risk as a result of tax avoidance and Mironov (2013) finds that income diversion reduces firm performance. In addition to that, Graham et al. (2014) and Gordon (1989) show that managers anticipate potential reputational concerns when they make tax avoidance decisions.

As ATRs are, in general, perfectly legal and provide tax certainty, LuxLeaks was – at the time of its revelation – not associated with any expectations about penalties or additional taxes. Previous literature shows that fines and penalties influence the market response (e.g., Karpoff and Lott, 1993). Unlike prior examinations of tax avoidance detections (e.g., Hanlon and Slemrod, 2009; Gallemore et al., 2014), our unique setting therefore allows us to eliminate a potential, negative effect caused by penalties and additional taxes. Other collaborating negative effects remain. As the MNCs investigated in this study elicited severe public criticism, we argue that, in particular, the capital market might view LuxLeaks in the same negative light as the press presented it, due to a loss of reputation.

Taking the different potential effects into account, we cannot predict unambiguously how the capital market will react to tax avoidance. Aiming to shed light on the impact of these different effects, we test the following to hypothesis H1a contrarian hypothesis:

H1b. *The capital market reaction to LuxLeaks should be negative if the reputational effects of disclosing tax avoidance predominate.*

4.2.3 Cross-Sectional Predictions for Different Levels of Tax Avoidance Already Disclosed

In the particular case of LuxLeaks, a positive effect of sophisticated tax planning can be attributed to two features: a capital market reward for a commitment to engage in tax avoidance or news about tax certainty and low litigation risks due to the ATR. We aim to disentangle the two effects by considering previous literature which suggests that the capital market response to news about tax avoidance depends on the level of tax avoidance already disclosed. In particular, previous studies differentiate between high- and low-ETR firms (Hanlon and Slemrod, 2009; Hill, Kubick, Lockhart, and Wan, 2013; Brooks et al., 2016).

A low ETR is perceived as a result of aggressive tax avoidance strategies. Moreover, Dyreng et al. (2017) find that low ETRs are associated with additional uncertain tax positions. Therefore, the capital market should anticipate a higher risk of additional taxes and penalties for these tax aggressive firms.[62] Studying the effect of lobbying, Hill et al. (2013) show that the generally positive effect of a firm's engagement in tax planning does not hold for firms with low ETRs. Brooks et al. (2016) and Guenther, Matsunaga, and Williams (2017) find a relation between high levels of tax avoidance and tax risk, respectively, with high stock price risk.

The ATRs disclosed by the LuxLeaks publications, however, eliminate at least part of the litigation risks associated with aggressive tax avoidance strategies. In line with this argument, Diller et al. (2017) show that ATRs, which eliminate the uncertainty of the otherwise risky tax planning, should attract tax aggressive firms. Consequently, news about a firm having an ATR with Luxembourg provides information to the capital market about a sustainable form of tax planning without the risk of additional taxes.

While for low-ETR firms the LuxLeaks publications do not reveal much information about the firms' general commitment to tax avoidance, the capital market should reward MNCs because the investors are relieved that the MNCs suffer less tax risk than originally expected.

[62] Hasan et al. (2014) show, for example, that banks associate tax avoidance of MNCs with significant risks.

Therefore, the positive effect associated with the information about reduced tax uncertainty should be especially distinct for firms with extraordinarily low ETRs. We test the following hypothesis:

H2a. *The capital market reaction to LuxLeaks should be particularly positive for firms with extraordinarily low ETRs because LuxLeaks provides new information about low litigation risks.*

In contrast, MNCs with high ETRs are believed to engage in less tax avoidance. In fact, the market does not expect any tax planning from them. In their study of capital market reactions to tax shelter involvement, Hanlon and Slemrod (2009) find no negative capital market effect for high-ETR firms. They argue that the market rewards the fact that those firms are "not as tax-passive as previously believed" (Hanlon and Slemrod, 2009, p. 127). This is in line with the undersheltering puzzle (Weisbach, 2002), according to which investors wonder why not all firms engage in tax avoidance. Consequently, any new information about involvement in tax planning should positively influence the capital market reaction for those firms that are perceived as passive in terms of tax avoidance. In the case of LuxLeaks, the capital market receives information that the MNC is not only involved in international tax avoidance but that it has a legally assured tax avoidance structure. Nevertheless, as ATRs have been signed prior to LuxLeaks, investors might believe the ATRs to be ineffective as the MNC still exhibits high ETRs. Therefore, we might expect a negative capital market reaction due to disappointment. However, as high ETRs represent a serious competitive disadvantage, we believe that the positive surprise outweighs other concerns. Thus, we hypothesize the following:

H2b. *The capital market reaction to LuxLeaks should be particularly positive for firms with extraordinarily high ETRs because LuxLeaks provides new information about their involvement in a sophisticated tax planning structure.*

4.3 Research Design

4.3.1 Data and Sample Selection

The information needed to perform our analyses is gathered from different data sources. In addition to the information revealed by the ICIJ, the stock prices and accounting data used in this study stem primarily from *Compustat North America* and *Compustat Global*. We augment the data by filling in missing values with corresponding information from *Datastream* and consolidated financial reports. All index price information is taken from *Datastream*.

Table 1. Sample Selection

Description	# of firms
Firms revealed by ICIJ	345
Less:	
Firms that cannot be identified as public firms	150
Missing identifier in *Compustat* for parent company	20
Missing leading index in *Datastream* and missing data in *Security Daily*	23
Firms that were revealed on December 9, 2014	4
Sample 1	**148**
Less:	
Missing financial data in *Compustat*	2
Missing cash effective tax rate	43
Sample 2	**103**

Notes: Table 1 describes the sample selection process of sample 1 (baseline sample) and sample 2 (ETR subsample). Starting point are the 345 firms that were revealed by the ICIJ. Data availability in the used databases as well as the focus on November 5, 2014, result in a baseline sample of 148 firms. The ETR subsample contains only 103 firms for which the CASH ETR as defined in table A1 of the appendix can be calculated.

We apply the following data selection process. We start from 345 firm names released by the ICIJ on November 5, 2014. In a first step, we only retain public firms that we can identify as being listed on a capital market. We use either the corresponding *Compustat North America/Compustat Global* identifier (gvkey) or the international securities identification number (ISIN). We lose many firms that are not listed on the stock market (private firms) and, thus, their stock prices are not available. We drop firms if we cannot find a reliable index for their countries on *Datastream* or if the daily prices on *Security Daily* or *Datastream* are missing or incomplete. The latter are needed to appropriately calculate a firm's (cumulated) abnormal

return (CAR). We retrieve all price information from Monday to Friday and use each firm's daily closing price. We further exclude firms that were revealed by the ICIJ in December 2014.[63] Finally, we are left with quoted stock prices from 22 countries. This leads – for our main event (LuxLeaks on November 5, 2014) – to a baseline sample of 148 revealed firms (sample 1).

In addition, we conduct further inquiries regarding the capital market reaction depending on the previously disclosed level of tax avoidance. Our requirement is financial data to calculate cash effective tax rates.[64] Due to missing firm-level information, we can only consider a somewhat smaller sample for these additional tests (sample 2). Table 1 shows the sample selection process.

A complete list of the MNCs included in our baseline sample, with their respective headquarters locations and industry classifications, is provided in table A2 of the appendix. A total of 22 countries is included in our sample. Most MNCs are located in the United States or the United Kingdom. The firms are from various industries like manufacturing, high tech, consumer, and health industry. However, a large group of MNCs included in LuxLeaks operates in the financial sector.[65]

Panel A of table 2 provides a first indication of a positive net effect of unintended disclosure of tax avoidance as the CARs of LuxLeaks firms are positive and much higher than those of other firms in the same countries. The median shows that CARs are more or less equally spread above and below 0 (0.0031). In sample 1, the minimum value is -0.18 and the maximum 0.24 for LuxLeaks firms. Furthermore, figure A2 of the appendix shows that the values roughly represent a normal distribution.

[63] As this second event revealed eight firms of which only four meet our initial data requirements, we exclude them due to comparability in our sample as this second event experienced considerably less media coverage.
[64] Following Hanlon and Slemrod (2009), we set ETRs, in general defined as tax expenses over pretax income, below 0 and above 0.5 to missing in order to limit the influence of extraordinary tax payments.
[65] We consider the Fama and French industry classification. Updated industry classification can be downloaded from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/changes_ind.html.

Table 2. Descriptive Statistics

Panel A: Descriptive statistics of cumulated abnormal returns				
	# of firms	Mean	Median	Std. dev.
LuxLeaks firms in sample 1	148	0.0122	0.0031	0.0496
LuxLeaks firms in sample 2	103	0.0119	0.0055	0.0342
Other listed firms in the same countries	7,437	-0.0007	0.0003	0.1575

Panel B: Descriptive statistics of LuxLeaks firms (sample 2)				
Variable	# of firms	Mean	Median	Std. dev.
CASH ETR	103	0.2151	0.2155	0.1211
SIZE (Total Assets logged)	99	10.2799	10.0203	2.1599
ROA (Return on Assets)	103	0.0787	0.0532	0.1043
LEV (Leverage)	99	0.0504	0.0247	0.0663

Panel C: Descriptive statistics of other listed firms in the same countries				
Variable	# of firms	Mean	Median	Std. dev.
CASH ETR	7,437	0.1457	0.1264	0.1401
SIZE (Total Assets logged)	7,437	6.3769	6.2109	2.0082
ROA (Return on Assets)	7,437	0.1036	0.0630	1.2708
LEV (Leverage)	7,437	0.0705	0.0287	0.1023

Notes: Panel A shows descriptives of the calculated cumulated abnormal returns applying the market model. Panel B and C show descriptive statistics of firms included in sample 2 (ETR subsample) for which all firm-specific data is available as well as for other firms located in the same countries. Financial data is taken from the consolidated financial statements 2013 available in *Compustat North America/Compustat Global*. CASH ETR is defined as taxes paid divided by pretax income; SIZE is the logarithm of total assets (before taking the logarithm, total assets are measured in million U.S. Dollars); Profitability, i.e., return on assets (ROA) is defined as pretax income divided by total assets; Leverage (LEV) is calculated as debt in current liabilities divided by total assets. Regarding the ratios, variables are left in their original currency for calculation.

Panel B of table 2 lists some descriptive statistics for our ETR subsample consisting of 103 LuxLeaks firms. To investigate the representativeness of our sample, panel C of table 2 displays statistics for all other listed firms with available firm-level data located in the same 22 countries. Table 2 shows that all firms have a reasonable return on assets and are not highly leveraged. LuxLeaks firms exhibit a mean CASH ETR of 21.5 % whereas all other firms – excluding the LuxLeaks firms – report a smaller CASH ETR of 14.6 %. Interestingly, in general, LuxLeaks firms seem to not avoid more taxes in terms of CASH ETR. Another difference occurs with regard to firm size. The MNCs involved in LuxLeaks and included in

our sample seem to be rather large. Thus, even though we are operating with a small sample[66], our sample covers a significant market volume.

4.3.2 Research Methodology

We analyze the capital market reaction, i.e., share price effects, to disclosure of tax avoidance by implementing an event study methodology that considers CARs as proposed by MacKinlay (1997) and Kothari and Warner (2007). Market efficiency results in investors quickly reacting to the news (Ball and Brown, 1968). This means we investigate the abnormal returns of MNCs over a short period surrounding the disclosure of information. A CAR is equal to the sum of daily abnormal returns. The latter is explained by the difference of the realized return and an expected return. CARs are computed using the market model in a first step (MacKinlay, 1997; Nelson, Price, and Rountree, 2008):

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (1)$$

R_{it} represents the daily (t) return of a firm's (i) share, whereas R_{mt} symbolizes the daily return of the market portfolio. ε_{it} is a zero mean disturbance term. As a proxy for the market portfolio, we consider the leading index of firm i's country. The applied indices for each country are displayed in table 3.

By using a different index for each country, we implicitly control for any home market shocks that may affect the daily returns around our event date. For example, one day before our event, the U.S. midterm elections took place. The outcome could certainly affect corporations' share prices. However, as the effect applies to the whole U.S. market, it is incorporated into the leading share index, which then serves as the benchmark for the calculation of abnormal returns. Thus, abnormal returns should only capture effects that are specific to certain firms.[67]

[66] Rather small samples are very common in literature that covers the capitalization of tax sheltering (i.e., aggressive tax avoidance). Hanlon and Slemrod (2009) use a sample of 108 tax shelter firms to investigate the CARs after the involvement in tax sheltering. Gallemore et al. (2014) apply a sample of 118 corporations.

[67] Please note that about 5 % of the benchmark firms are LuxLeaks firms as some of the latter are listed in the leading indices of their respective country. This may possibly result in an underestimation of effect size.

Table 3. Considered Capital Markets

Country	Leading Index	LuxLeaks firms	Country	Leading Index	LuxLeaks firms
Australia	All Ordinaries	4	Italy	FTSE MIB	6
Belgium	BEL20	4	Japan	Nikkei 225	4
Bulgaria	Sofix	1	Luxembourg	LuxX Index	6
Canada	TSX Composite	6	Norway	OBX Index	1
China	SSE Composite	1	Philippines	PSEi	1
Finland	OMX Helsinki 25	1	Russia	RTS-Index	2
France	CAC40	8	Sweden	OMX Stockholm 30	2
Germany	DAX	10	Switzerland	SMI	11
Hong Kong	Hang Seng HSI	1	Taiwan	TAIEX	1
Ireland	ISEQ Overall Index	8	UK	FTSE 100 Index	22
Israel	TA-100	2	USA	Dow Jones	46

Notes: Table 3 lists the 22 countries included in our baseline sample, the respective leading index which is used as a benchmark in calculating the abnormal returns of a firm *i* in that country, and the number of LuxLeaks firms considered.

We estimate equation (1) for each share using a window of 100 days, ending 6 days before the considered event to ensure that no pricing information related to the event affects the predictive factors (MacKinlay, 1997). Then, we use our estimates to predict each share's return ($R_{it}^{predicted}$) for each day belonging to the event window. Next, we calculate the daily abnormal returns by subtracting the predicted returns from the actual returns, which we find in our databases. CARs are subsequently computed as the sum of abnormal returns over the event window (equation (2)). In most of our analyses, we apply a seven-day event window from -3 to +3 assuming our event took place on day t_0.

$$CAR_i = \sum_{t=t_{-3}}^{t=t_{+3}} (R_{it} - R_{it}^{predicted}) \quad (2)$$

Finally, we exert a two-tailed t-test to check whether the mean CAR of LuxLeaks firms is significantly different from 0. A positive and significant result would be consistent with hypothesis H1a, whereas a significantly negative estimator would suggest support for hypothesis H1b. At this point, it has to be noted that if the event day is the same for all sample firms, abnormal returns tend to be cross-sectionally correlated. This may result in an over-

rejection of the null hypothesis. Therefore, we report adjusted standard errors according to Kolari and Pynnönen (2010) in an additional column as their test statistic takes the potential correlation into account.[68]

An alternative method to compute abnormal returns is denoted as the market adjusted model (MacKinlay, 1997). In this model, the corresponding country's index return is subtracted from the firm's actual return. Considering equation (1), α_i is set to 0 and β_i is set to 1 for all shares. The market adjusted model therefore provides a much simpler way to predict each share's return compared to the market model. Put differently, it provides an alternative approach with significant limitations (MacKinlay, 1997). As this method is, however, used by related studies investigating market responses to tax avoidance (Hanlon and Slemrod, 2009; Gallemore et al., 2014), we consider it as a robustness check.

4.4 Results

4.4.1 Cumulated Abnormal Returns around LuxLeaks

In this section, we present our results for the capital market reaction to LuxLeaks on November 5, 2014. According to the discussion in section 4.2, our prediction of the sign of the capital market reaction is ambiguous. On the one hand, shareholders may reward the unintended disclosure of MNCs as, through LuxLeaks, new information about their commitment to tax avoidance and, in particular, to an involvement in legally assured tax avoidance, became publicly known (H1a). On the other hand, shareholders may punish the same MNCs, as stock prices mirror possible reputational losses (H1b). We test which effect dominates using the methodology described in section 4.3.

Table 4 presents the mean CARs for the LuxLeaks firms. Across different event windows, we find positive CARs. We consider coefficient estimates significant if $p<0.1$ in a two-tailed test reflecting the competing predictions in hypotheses H1a and H1b. Considering

[68] To implement different test statistics, we employ the non-official Stata command eventstudy2 programmed by Kaspereit (2015).

the common test statistic, CARs are statistically significant across several event windows. However, if we account for cross-sectional correlation, only the CAR of the seven-day (-3/+3) event window is significant.[69] This result suggests that LuxLeaks firms, on average, show CARs of 1.22 %[70] over the seven days surrounding the LuxLeaks announcement. This effect means that LuxLeaks firms achieve an abnormal return that is 1.22 percentage points higher than the market return.[71] The effect size is also economically meaningful. For example, the U.S.-based firm Procter & Gamble has approximately 2.7 billion shares outstanding, which had a closing price of roughly $ 87 three days prior to LuxLeaks leading to a firm value of $ 235 billion. Considering the mean CAR of LuxLeaks firms of 1.22 %, Procter & Gamble was able to increase firm value by $ 2.9 billion more than an average U.S. corporation listed in the Dow Jones within the seven days surrounding November 5, 2014.

Table 4. CARs for Different Window Lengths

CARs applying the market model				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
Window length: -3/+3	148	0.0122	0.0034***	0.0063*
Window length: -2/+2	148	0.0054	0.0028*	0.0052
Window length: 0/+3	148	0.0057	0.0026**	0.0068

Notes: Table 4 presents cumulated abnormal returns for the baseline sample. The results are shown for varying window lengths. We consider the market model to calculate abnormal returns. In an additional column, we report standard errors adjusted for cross-correlation according to Kolari and Pynnönen (2010). *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

To mitigate a possible bias from other events influencing the results, we also consider shorter event windows. Shortening the event window to 2 days before and after the event also results in positive CARs (0.0054). Even excluding all days prior to LuxLeaks indicates a positive capital market reaction. The exclusion obviously leads to smaller CARs, as it must be

[69] Outliers as visible in figure A2 of the appendix may influence the results. However, results are mostly robust to excluding outliers, i.e., corporations with CARs in the lowest and highest percent of the CAR distribution (compare table A3 of the appendix). Point estimates decrease slightly, but significance levels remain very similar.

[70] In absolute values, the effect size is similar in magnitude to the CARs found in previous event studies, e.g., Hanlon and Slemrod (2009) reported 0.53 % and Gallemore et al. (2014) 0.75 %. Even though our effect is positive whereas other studies mainly find negative effects.

[71] Please note that, in this context, market return is a stylized expression for the term $\beta_i * R_{mt}$. Consequently, the abnormal return is determined for each firm by its individual correlation with the return of the respective leading index.

assumed that some rumors prior to the leak had already affected market returns. Moreover, the shorter event windows appear to be more affected by cross-sectional correlation as results are not robust to adjusted standard errors. Therefore, we mainly consider the seven-day event window in additional analyses.

Table 5. Robustness Tests

Panel A: Exclude underrepresented markets				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
Window length: -3/+3	135	0.0135	0.0034***	0.0067**
Window length: -2/+2	135	0.0062	0.0029**	0.0053
Window length: 0/+3	135	0.0061	0.0026**	0.0067
Panel B: U.S. corporations				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
Window length: -3/+3	46	0.0204	0.0054***	0.0165
Window length: -2/+2	46	0.0111	0.0045**	0.0147
Window length: 0/+3	46	0.0091	0.0041**	0.0091
Panel C: EU corporations				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
Window length: -3/+3	68	0.0095	0.0053*	0.0057*
Window length: -2/+2	68	0.0012	0.0044	0.0021
Window length: 0/+3	68	0.0016	0.0040	0.0222
Panel D: Market adjusted model				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
Window length: -3/+3	148	0.0280	0.0039***	0.0171
Window length: -2/+2	148	0.0062	0.0032*	0.0299
Window length: 0/+3	148	0.0176	0.0029***	0.0119

Notes: Table 5 presents robustness tests to our main findings presented in table 4. The results are shown for varying window lengths. In panel A, we exclude countries in which less than three LuxLeaks firms are headquartered and panel B and C show the results for U.S. and EU corporations only. Panel D repeats the prior analysis using the market adjusted model to compute the CARs. In an additional column, we report standard errors adjusted for cross-correlation according to Kolari and Pynnönen (2010). *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

Table 5 provides results of some robustness checks. First, we exclude markets that are underrepresented from our sample. That is, we exclude countries in which less than three LuxLeaks firms are headquartered. The positive CARs as shown in panel A of table 5 are comparable to our main findings in table 4. In panel B, we consider the subsample of U.S.

corporations. We also find positive CARs. In line with these results, Marian (2017) states that more U.S. firms avoid taxes using ATRs in Europe and Dyreng and Lindsey (2009) provide evidence of U.S. firms' success in avoiding foreign taxes. Nesbitt, Outslay, and Persson (2017) perform a similar analysis focusing on firms listed on the U.S. stock exchange. The magnitude of their findings covering the same event window is smaller with a mean CAR of 0.38 %. However, they do not account for cross-sectional correlation. Robust statistical significance, that is to say, can only be found for corporations from the European Union (EU) as shown in panel C. In panel D of table 5, we alternatively apply the market adjusted model to calculate expected returns because it is used by related studies. We reveal similar positive CARs using the alternative method. Again, accounting for cross-sectional correlation results in a loss of significance. Nevertheless, we interpret these results with some caution because only the standard market model considers the specific correlation between the performance of the market and the single share.

Overall, we find mostly positive and significant CARs. However, some effects are influenced by cross-sectional correlation. Thus, we can only cautiously infer that the capital market rewards MNCs for credible information about engaging in ATRs with the tax authorities in Luxembourg. Thereby, our findings suggest some evidence for hypothesis H1a. Nevertheless, as we do not find any negative CARs, the dominance of reputational effects, as proposed in hypothesis H1b, can be declined. Positive and negative effects are at least equally balanced or, as our results suggest, the potential reputational effects are outweighed by the positive effects of disclosing sophisticated tax planning.[72] The latter can be attributed either to a capital market reward for a commitment to engaging in tax avoidance or to the particularly positive feature of additional tax certainty provided by an ATR. It is, however, a challenging

[72] Even though we identify a rather positive effect of disclosure of tax avoidance on firm value, it has to be noted that these results cannot directly be used to assess the capital market reaction to voluntary disclosure. As described in section 2.1, MNCs did not voluntarily disclose ATR information before the leak due to a potentially negative perception by investors. Even after the leak, other MNCs did not claim to be involved in ATRs as their disclosure may also be perceived as boasting, be less credible, and thereby, lead to predominantly negative effects.

empirical task to disentangle the two mechanisms. As described in section 4.2, the effectiveness of the two mechanisms depends on the level of tax avoidance that was already disclosed to the capital market *before* the news about LuxLeaks was released. We therefore distinguish between different levels of tax avoidance already disclosed by the LuxLeaks firms.

More precisely, we analyze the capital market reaction to LuxLeaks for different levels of ETRs. We consider a firm's CASH ETR (taxes paid divided by pretax income) and GAAP ETR (total income taxes divided by pretax income)[73]. As we aim to approximate the level of tax avoidance that was disclosed before LuxLeaks, we consider financial statement data from 2013. Due to missing financial data, we are left with a somewhat smaller sample. In panel A of table 6, we therefore repeat the initial test for the subsample. The mean CAR (0.0119) is again positive and significant.

In panel B of table 6, we divide our sample into four subsamples, one for each quartile of the ETR distribution. We find positive and significant CARs only for firms with extraordinarily low CASH ETRs (below 12.71 %) and for firms with extraordinarily high CASH ETRs (above 30.35 %). Firms with moderate levels of tax avoidance show CARs that are small and statistically insignificant. Thus, our results suggest that the level of tax avoidance that was already disclosed before the LuxLeaks event affects the capital market reaction around the LuxLeaks announcements. Moreover, our results suggest that the positive responses can be attributed to two different mechanisms.

The positive capital market reaction for MNCs with particularly high ETRs is in line with the view that additional information about firms' engagements in tax avoidance positively surprises shareholders. Until the revelation by the ICIJ, the LuxLeaks firms with high ETRs cannot be identified as being particularly engaged in tax avoidance. The news about a firm's commitment to tax avoidance is rewarded by the capital market. Regarding low-ETR firms, the

[73] For an overview on measures of tax avoidance see Hanlon and Heitzman (2010).

capital market could already assume a strong engagement in tax planning strategies. Therefore, our results, showing a particularly positive response to the disclosure of certain tax avoidance strategy for firms that had not already disclosed small ETRs, are in line with hypothesis H2b.

Table 6. CARs for Different Levels of Tax Avoidance

Panel A: Initial test				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
ETR subsample	103	0.0119	0.0037***	0.0057**
Panel B: Tax avoidance measured by CASH ETR				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
CASH ETR below 25th percentile	26	0.0171	0.0063***	0.0128
CASH ETR above 25th percentile and below median	26	0.0072	0.0064	0.0071
CASH ETR above median and below 75th percentile	26	0.0039	0.0082	0.0046
CASH ETR above 75th percentile	25	0.0199	0.0090**	0.0114*
Panel C: Tax avoidance measured by GAAP ETR				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
GAAP ETR below 25th percentile	30	0.0128	0.0104	0.0097
GAAP ETR above 25th percentile and below median	30	0.0102	0.0064	0.0079
GAAP ETR above median and below 75th percentile	30	0.0092	0.0054*	0.0110
GAAP ETR above 75th percentile	30	0.0196	0.0064***	0.0108*

Notes: Table 6 presents the results of the t-tests that are applied to test hypotheses H2a and H2b. CARs are the mean cumulated abnormal returns over a seven-day event window (-3 to +3 where 0 is the event day). We consider the market model to calculate abnormal returns. The level of tax avoidance is measured by cash effective tax rates. CASH ETR is taxes paid divided by pretax income. Data availability reduces the sample size to 103 firms. Panel A repeats the first analysis of table 4 to justify the application of a reduced sample. Panel B differentiates between firms with high and low CASH ETRs. Panel C considers a different measure of tax avoidance. GAAP ETR is total taxes divided by pretax income. Due to higher data availability, the GAAP ETR sample consists of 120 firms. In an additional column, we report standard errors adjusted for cross-correlation according to Kolari and Pynnönen (2010). *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

The positive capital market reaction for MNCs with extraordinarily low ETRs can be attributed to the additional tax certainty associated with an ATR. Because extensive tax avoidance is associated with serious litigation risks and potentially additional taxes in future

years, share prices should reflect some level of discount if a firm discloses an extraordinarily low ETR. The LuxLeaks announcement provides news about legal certainty for part of the firm's tax avoidance. Consequently, the information is especially positive. One might argue that LuxLeaks also provides information about tax certainty for all involved firms. If disclosed ETRs were moderate or even high, the capital market might not even expect significant tax risks before the LuxLeaks announcements. Consequently, the presented positive market reaction to LuxLeaks for low-ETR firms is in line with our hypothesis H2a. However, the effect is insignificant if we apply adjusted standard errors.

For firms with CASH ETRs in the interquartile range, we find no significant capital market response. Our results, however, suggest that potential negative effects are at least outweighed by positive effects due to new information about an engagement in an additional and secure type of tax avoidance. Firms that reported a moderate CASH ETR prior to the LuxLeaks event might be perceived as already committed to some sophisticated tax avoidance.

In panel C of table 6, we consider GAAP ETR as an alternative measure to disclose tax avoidance. Again, we analyze the response to LuxLeaks for different levels of ETRs disclosed in 2013, the financial year before LuxLeaks arises. Our results only suggest a robust positive effect of news about involvement in tax planning for firms that disclosed very high GAAP ETRs (above 29.12 %). The results are consistent with hypothesis H2b, i.e., a positive capital market response to new information about involvement in sophisticated tax avoidance. However, we cannot find any support for news merely about tax certainty (H2a).[74]

The results for different levels of GAAP ETR may originate in the definition of GAAP ETR. As total income taxes (nominator) include current as well as deferred taxes, tax avoidance

[74] UTBs (unrecognized tax benefits) disclosed according to FIN 48 might be another potential measure for additional analyses, as they provide the capital market with information about tax certainty. However, data on UTBs is only available for U.S. firms and splitting a U.S. subsample (46 MNCs) into yet another four groups leads to insufficient small sample sizes. Therefore, we perform an additional test with the commonly applied three-year volatility of CASH ETR as a measure of tax risk, which also provides the capital market with information about tax certainty. The results are displayed in table A4 of the appendix. We find that especially corporations with low tax risk are significantly rewarded by the capital market. Even though this implies that investor value tax certainty, this does not suggest support for hypothesis H2a as one would expect significant effects for high-risk firms.

structures such as increased deductions and deferral of income are not reflected by GAAP ETRs (Dyreng, Hanlon, and Maydew, 2008). Thus, investors may perceive GAAP ETR as an imperfect measure of tax avoidance and the associated risk.

4.4.2 Additional Tests

Our baseline results suggest a rather positive response to the LuxLeaks event. Potential negative effects are balanced or even dominated by other opposing effects. In additional analyses, we further scrutinize these potential negative effects of disclosing tax avoidance, i.e., reputational losses and the litigation risk.

Industry Membership

In table 7, we exploit how the capital market reacts to MNCs with different characteristics in the context of LuxLeaks. First, we consider industry membership (panel A of table 7) because reputational losses might vary across industries.[75] As far as common belief about reputation goes, negative media coverage, such as the news about LuxLeaks may have a stronger impact on firms that face the end-customer. If consumers respond to news about aggressive tax avoidance with a buying resistance, or if business-to-consumer relationships are important, we would expect particularly negative effects for consumer industries.

However, our results do not confirm this expectation. Instead, we find robust positive CARs for firms from the business-to-consumer industries[76]. These counterintuitive results are in line with prior literature studying reputational effects in the context of tax planning. Austin and Wilson (2015) can neither confirm nor reject that firms with valuable brands engage in more tax avoidance and Gallemore et al. (2014) have difficulties identifying a reputational effect of tax sheltering.

[75] We only consider 146 firms in panel A of table 7 due to two missing data on industry codes.
[76] We consider industries 2, 3, 4, 5, 6, 7, 8, 9, 10, 43, 44 of the 49 Fama and French industry classification as business-to-consumer industries. Remaining industries are classified as business-to-business firms or financial firms.

Additionally, we consider a subsample of financial firms because many LuxLeaks firms can be classified as financial institutions. However, those exhibit no significant capital market reaction.

Table 7. CARs for Different Firm Characteristics

Panel A: Industry membership				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
Business-to-consumer firms	18	0.0333	0.0086***	0.0179*
Business-to-business firms	69	0.0118	0.0057**	0.0100
Financial institutions	59	0.0068	0.0047	0.0055
Panel B: Profitability				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
ROA below (and incl.) median	52	0.0127	0.0051**	0.0080
ROA above median	51	0.0112	0.0055**	0.0065*
Panel C: Firm size				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
Size below (and incl.) median	50	0.0216	0.0059***	0.0100**
Size above median	49	0.0038	0.0049	0.0046

Notes: Table 7 presents additional results of cross-sectional t-tests to further analyze hypothesis H1b. CARs are the mean cumulated abnormal returns over a seven-day event window (-3 to +3 where 0 is the event day) for the examined firms. We consider the market model to calculate abnormal returns. In panel A, the baseline sample is divided into three different industry groups according to Fama and French industry classification. Panel B differentiates between firms with high and low ROA measured as firm's pretax profit divided by total assets. Panel C differentiates between smaller and larger firms. Firm size is measured by the logarithm of total assets. In an additional column, we report standard errors adjusted for cross-correlation according to Kolari and Pynnönen (2010). *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

Market Position

The lack of evidence for reputational effects might be explained by the strong market position of a MNC. If a MNC has a strong market position, customers might not respond significantly to news about aggressive tax avoidance. Consequently, MNCs with strong market positions can more easily compensate for reputational losses than firms who already suffer from intense competition. We approximate a firm's market position by profitability (pretax profit divided by total assets) and SIZE (logarithm of total assets). Considering subsamples below and above the median of ROA and SIZE, we expect positive and significant CARs for the highest

values of the two measures. Panels B and C of table 7 depict the results for the capital market response to LuxLeaks.

In panel B, we find a positive and robust capital market reaction for the most profitable firms. The influence of reputational concerns seems to be more easily compensated by MNCs with a strong market position. However, regarding firm size, table 7 does not reveal the expected results, as we would have assumed a higher influence of reputational concerns for small firms. The positive effect for small firms (0.0216) may be due to a stronger perception by the capital market of the news about involvement in tax avoidance. For large multinationals the capital market receives abundant information whereas smaller firms are rarely mentioned in the media (Brooks et al., 2016). Thus, our results do not support reputational effects.

As even more detailed analyses do not provide evidence for hypothesis H1b, we conclude that possible reputational effects due to unintended disclosure of tax avoidance and resulting from unfavorable media coverage seem to be less relevant to the capital market. Instead, the results hint at further support of hypothesis H1a, which states that the positive effects of additional information about a low litigation risk outweigh reputational losses.

Reaction to Potential Removal of Tax Benefits

So far, we have analyzed the capital market response to the LuxLeaks disclosure of tax structures characterized by particularly low litigation risks because all cases include a binding ATR. Therefore, the positive valuation of LuxLeaks by the capital market can be – at least partly – explained by disclosure of reduced tax payments associated with a low level of tax litigation risk. What happens if the low level of litigation risk is removed, i.e., the risk increases?

In the aftermath of the leak, an unexpected debate arose over whether special tax deals might conflict with European law. Even though the ATRs released in the course of LuxLeaks represent binding legal documents on a national level, they also have to comply with European law. To be precise, this debate did not affect the perception of LuxLeaks around the date of its

revelation as, to the best of our knowledge, a potential conflict with European law was not expected in November 2014.

Almost one year after the ICIJ's publications, on October 21, 2015, the European Commission ruled – for the first time ever – on the question of illegal state aid in the cases of Fiat in Luxembourg and Starbucks in the Netherlands (European Commission, 2015). Starbucks and Fiat were granted tax advantages by fiscal authorities in the Netherlands and Luxembourg, respectively, which were not available to other MNCs. Similar to the LuxLeaks firms, Fiat and Starbucks had secured their tax planning through ATRs and were believed to have achieved tax certainty. According to the European Commission (2015), ATRs – in general – remain legal, however, these special cases lack an economic justification leading to unfair competitive advantages. The investigation by the European Commission was a new development and the European Commission had never ruled on special tax deals with tax authorities before. Therefore, we argue that the judgment was unexpected by the capital market.

While Fiat and Starbucks were not involved in the LuxLeaks publications[77], worldwide news immediately predicted additional judgments for other MNCs involved in tax agreements with fiscal authorities and made connections to LuxLeaks.[78] As this decision may lead to further investigations of other firms, it poses a potential threat to the LuxLeaks firms. Thus, the capital market might anticipate judgments for LuxLeaks firms even though the latter had previously secured tax certainty. We therefore use this second event in October 2015 – almost one year after LuxLeaks – to scrutinize the potential removal of the low litigation risk.

As the LuxLeaks firms were not named by the European Commission in October 2015, we argue that reputational effects are very unlikely for this second event. Moreover, no

[77] Although Fiat was convicted based on a Luxembourg ATR, Fiat is not included in our sample of LuxLeaks firms because it was not one of the firms which were revealed by the ICIJ.

[78] For example, *The New York Times* (2015, October 21), available at http://www.nytimes.com/2015/10/22/business/international/starbucks-fiat-eu-tax-netherlands-luxembourg.html, and *BloombergBusiness* (2015, October 21), available at http://www.bloomberg.com/news/articles/2015-10-21/starbucks-fiat-first-in-firing-line-as-eu-orders-tax-repayments-ig0kk625.

additional information about an involvement in tax planning was revealed in October 2015. Consequently, the effect of a potentially higher litigation risk can be isolated. If the capital market anticipates similar future judgments, i.e., an ex post amendment for LuxLeaks firms and their ATRs, we expect a negative capital market reaction.

We use the date of the judgment and analyze the CARs of LuxLeaks firms surrounding October 21, 2015. Mean CARs are presented in table 8. We again consider different event windows. CARs are close to 0 and statistically insignificant. The capital market seems to not value the higher litigation risk or even anticipate any additional taxes for the LuxLeaks firms. Further tests in table A5 of the appendix show that even differentiating among the levels of tax avoidance applied in previous tests does not provide further insight. The coefficients in the lowest and highest levels of tax avoidance are negative but statistically insignificant. Panel C and D of table A5 consider U.S. and EU firms, respectively. However, results remain insignificant. Consequently, we do not find evidence of negative effects due to a potential rise in litigation risk.

Table 8. CARs around European Commission Judgment

Mean CARs applying the market model				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
Window length: -3/+3	147	-0.0020	0.0041	0.0032
Window length: -2/+2	147	-0.0011	0.0035	0.0031
Window length: 0/+3	147	-0.0010	0.0031	0.0024

Notes: Table 8 presents the results of the t-tests that are applied to test a potential effect due to a rising litigation risk. CARs are the mean cumulated abnormal returns for the baseline sample. We consider the market model to calculate abnormal returns. The number of firms differs slightly to our previous baseline sample due to differing availability of price information. The results are shown for varying window lengths. In an additional column, we report standard errors adjusted for cross-correlation according to Kolari and Pynnönen (2010). *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

Several reasons might affect this evidence. First, a measurement error may occur as it is not fully clear when the capital market reacts to the judgment with respect to the new development. Judgments and changes in law are often widely anticipated, as they take a long time to develop. Thus, the capital market reaction may be spread over the months prior to or after the judgment and consequently, not be clearly identifiable. The study by Bauckloh,

Hardeck, Wittenstein, and Zwergel (2017), which investigates the capital market reaction to several events associated with European state aid investigations for U.S. corporations, finds some evidence of a negative reaction for U.S. LuxLeaks firms to a decision on the recovery of taxes and an announcement of state aid investigations at the end of 2015. Another explanation may be that the capital market does not believe in future, similar judgments, as it is precisely stated that ATRs are per se legal. Furthermore, investors might believe in support of the home country's political institutions (cf. Bauckloh et al., 2017). Last, the reduced certainty due to the possibility of additional taxes may simply not be reflected in share prices. This last argument is in line with prior research that had difficulty identifying an overall negative capital market reaction to tax sheltering (e.g., Hanlon and Slemrod, 2009).

4.4.3 Spillover Effect on Similar Firms

In additional tests, we analyze potential spillover effects of LuxLeaks disclosure on similar firms. One reason for this influence on other MNCs may be that almost all firms covered by LuxLeaks are clients of PricewaterhouseCoopers (ICIJ, 2014b; Marian, 2017). Thus, one might expect that other multinationals being advised by the remaining Big Four firms were just lucky to not be revealed. This is also in line with one strand of literature that shows the impact of one firm's behavior on the behavior of its peers (e.g. Gleason, Jenkins, and Johnson, 2008; Beatty, Liao, and Yu, 2013). Furthermore, as 32 out of all OECD countries offer ATRs (OECD, 2013), it is likely that Luxembourg is not the only country that engaged in special tax agreements with MNCs.

Moreover, spillover effects are well-known from other events. If one firm of a certain industry issues a profit warning, shareholders anticipate that the same will occur with other firms in the same industry. A prominent case, which recently dominated worldwide news and depicts this transfer of information, is the emissions scandal at Volkswagen. The German automobile manufacturer manipulated engines to produce certain emission values during

testing. On September 18, 2015, the scandal was revealed.[79] Following the event, share prices of Volkswagen dropped dramatically, but very similar German MNCs, such as BMW and Daimler, also experienced distinctive market losses. However, MNCs that are perceived to be different, e.g. Toyota as a non-German automaker exhibited a rather stable market performance and seemed to be unaffected by the event.[80] As the Volkswagen emissions scandal reveals, the capital market seems to expect the same behavior only of very similar firms. Considering the spillover effect of the emissions scandal on firms other than Volkswagen itself, LuxLeaks, i.e., unintended disclosure of engagement in ATRs, may have an effect on more than just the firms uncovered by the ICIJ.

To identify firms similar to the LuxLeaks firms, we apply a one-to-five nearest neighbor propensity score matching procedure according to Rosenbaum and Rubin (1983) and Caliendo and Kopeinig (2008). We calculate the propensity score based on SIZE, profitability, and leverage and we require that the matched firms be located in the same country and operate in the same industry. Furthermore, to reach a reasonable matching quality, we only consider firms with differences in propensity scores of less than 0.025.

We lose 21 firms of our sample 2 as no matching partners can be found. For the remaining 82 LuxLeaks firms, we find a total of 299 very similar firms, for which all necessary data is available. We apply our previously used event study methodology to the 82 LuxLeaks firms as well as to the 299 matched firms. The results of the t-tests are shown in table 9. Panel A considers the actual LuxLeaks event on November 5, 2014. The significant CAR of 0.0142 is consistent with prior results for the capital market reaction to LuxLeaks (cf. table 4). We also find a positive and significant result for very similar firms (0.0081). We do not report adjusted standard errors in table 9 as correcting for cross-sectional correlation would obviously result in

[79] On September 18, 2015, the United States Environmental Protection Agency issued the "notice of violation (NOV) of the Clean Air Act (CAA) to Volkswagen". *EPA* (2015, September 18), available at http://yosemite.epa.gov/opa/admpress.nsf/21b8983ffa5d0e4685257dd4006b85e2/dfc8e33b5ab162b985257ec40057813b!OpenDocument.

[80] Please compare figure A3 of the appendix for a depiction of mentioned share prices.

a loss of significance. By definition, the analyzed spillover effect can only exist due to cross-sectional correlation.[81] In panel B of table 9, we use the same matching partners with non-missing values to analyze a possible spillover effect to the removal of tax benefits on October 21, 2015. Consistent with results in table 8, we find no significant effect for LuxLeaks firms. However, for the other firms, we find a significant, negative effect (-0.0075).

Table 9. Spillover Effects on Similar Firms

Panel A: Mean CARs applying the market model for leakage of documents			
	# of firms	Mean CAR	Std. err.
LuxLeaks firms after matching	82	0.0142	0.0043***
Other firms after matching	299	0.0081	0.0028***

Panel B: Mean CARs applying the market model for removal of tax benefits			
	# of firms	Mean CAR	Std. err.
LuxLeaks firms after matching	82	0.0064	0.0048
Other firms after matching	290	-0.0075	0.0027***

Notes: Table 9 presents the results of the t-tests that are applied to test the effect of LuxLeaks on the overall capital market. CARs are the mean cumulated abnormal returns over a seven-day event window (-3 to +3 where 0 is the event day). We consider the market model to calculate abnormal returns. Similar firms are obtained by executing one-to-five nearest neighbor propensity score matching. In panel A, we consider the revelation of documents on November 5, 2014. In panel B, we analyze the effect with regard to the potential removal of tax benefits on October 21, 2015. As far as possible we use the same matching partners as in 2014. However, we do lose some observations due to missing data in 2015. *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

We conclude that the capital market anticipates similar firms to also be involved in sophisticated, i.e., legally assured tax avoidance through ATRs. With regard to the potential removal of tax benefits, investors of similar firms, in contrast to investors of LuxLeaks firms, anticipate a significant raise of litigation risk, which is worth to be reflected in share prices.

4.5 Conclusion

In this study, we examine the capital market reaction to the LuxLeaks publications on November 5, 2014. This revelation offered new and credible information about firms' involvement in sophisticated tax planning. Interestingly, these tax avoidance activities are accompanied by a low level of litigation risk because all involved MNCs had signed ATRs with

[81] Please note that as we do find a spillover effect for the investigated disclosure due to cross-sectional correlation, the necessity to apply adjusted standard errors in our main analyses becomes even more apparent.

the tax authority in Luxembourg. Using an event study methodology, we find robust evidence that the positive effects attributed to additional information about tax avoidance with low litigation risks balance potential negative reputational effects. They might even outweigh the latter as our findings suggest overall positive CARs.

In additional tests, we find a more pronounced positive capital market reaction to LuxLeaks for firms with extraordinarily high ETRs. This finding supports the argument that the capital market rewards new information about a firm's commitment to tax avoidance, particularly if new information about an involvement in secure tax planning is detected that had not already been disclosed by the ETR. However, we find only very limited evidence for the view that the capital market rewards information about low litigation risks for those MNCs that are perceived as particularly tax aggressive.

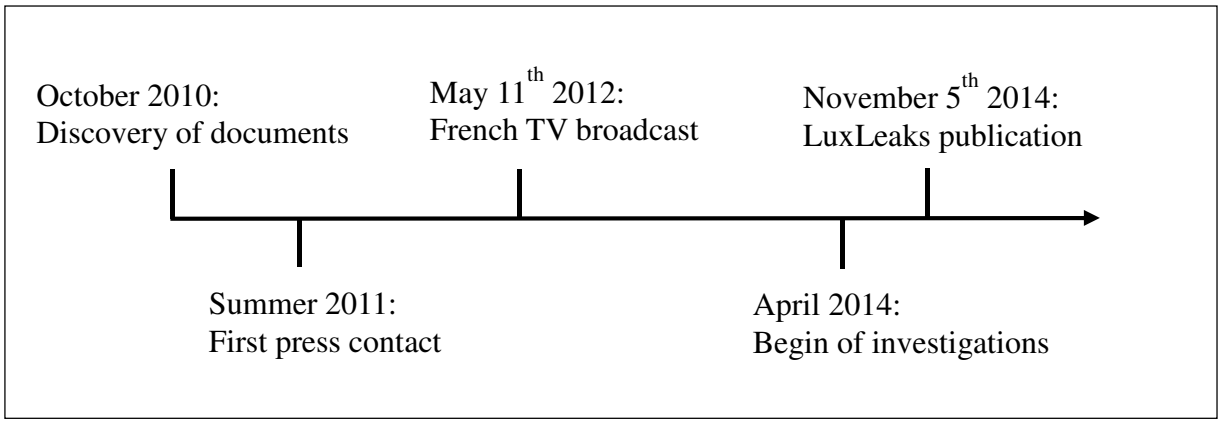
Our results contribute to the discussion about the impact of disclosing tax avoidance on firm value. Our results cast significant doubts on reputational effects. Instead, we find some evidence that the capital market potentially rewards unintended disclosure, which provides additional information about a commitment to tax avoidance that is not associated with litigation risks and additional taxes. Consequently, our results suggest that increased transparency about sophisticated tax planning strategies is not detrimental to MNCs and may even help to capitalize the competitive advantages of tax avoidance.

We acknowledge that our results are subject to some limitations. First, we only show a short-term effect of LuxLeaks on share prices. However, including a longer period as the event window increases the chance of a possible bias due to other influences. Second, our results may be questioned because taxes represent only a small fraction of the information that influences share prices, and some investors might simply not care about tax avoidance. Third, our results have to be interpreted with some caution as they only reveal effects of the specific analyzed disclosure, i.e., unintended disclosure of tax avoidance with low litigation risk, on equity holders of MNCs. The conclusion might not hold in the case of voluntary disclosure, which

may be perceived as boasting, be less credible, and thereby, lead to predominantly negative effects. Thus, future research on other forms of disclosure as well as research on the effect on credit market participants or customers may complement our results. Additionally, as prior literature shows, public and private firms exhibit different levels of tax avoidance (Badertscher, Katz, and Rego, 2013). Due to the design of our event study, we can only consider public firms. Therefore, future research on the effects of disclosing more details about tax avoidance on the firm value of private firms would be interesting.

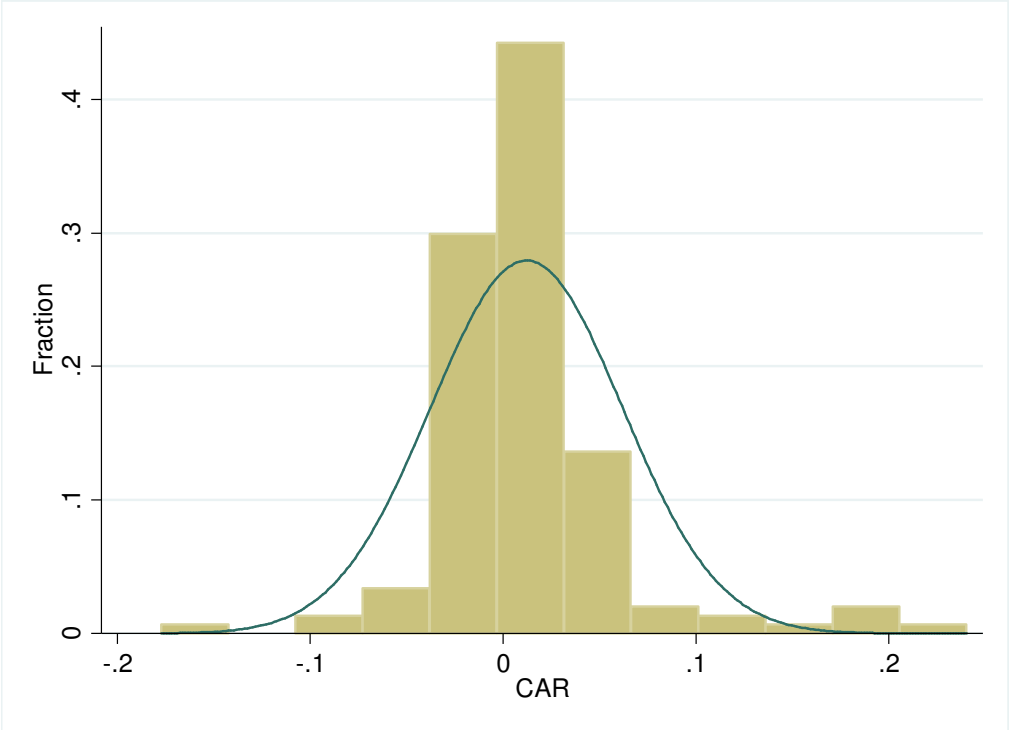
Appendix

Figure A1. LuxLeaks Timeline



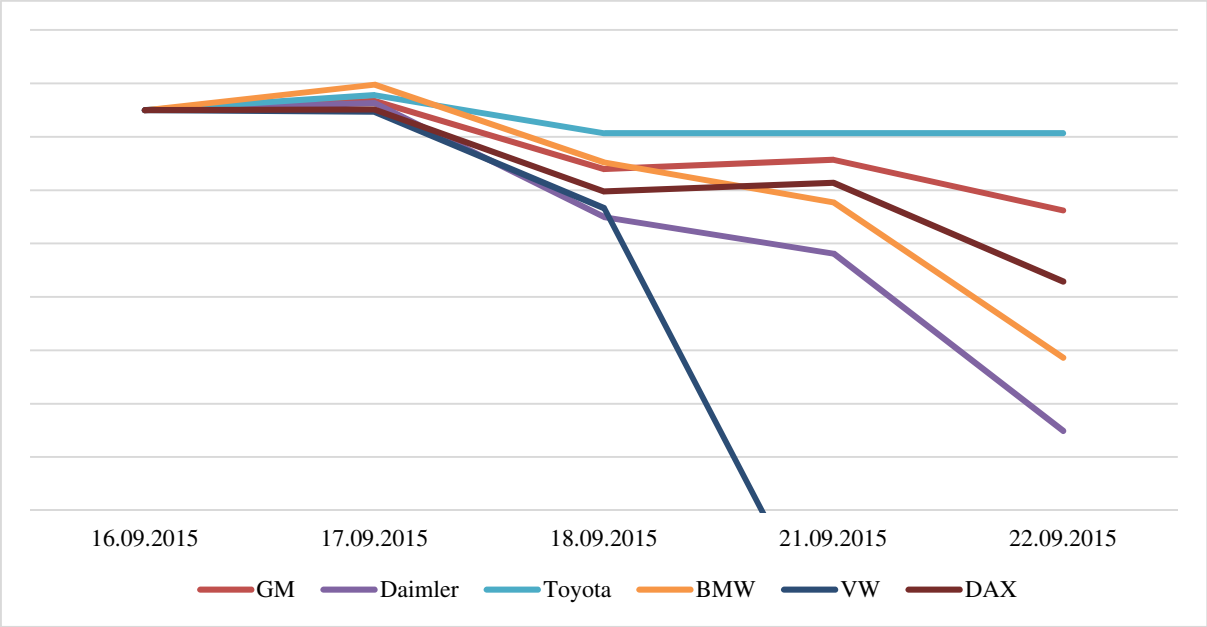
Notes: Figure A1 displays a timeline of events associated with LuxLeaks starting at the discovery of the documents by Antoine Deltour in October 2010 until the release of the documents through the ICIJ on November 5th, 2014.

Figure A2. Distribution of Cumulated Abnormal Returns



Notes: The columns in figure A2 present the distribution of cumulated abnormal returns in sample 1. The x-axis shows the value of CARs as defined in table A1 of the appendix, whereas the y-axis plots the respective fractions (in %) of all corporations in sample 1. The line represents a normal distribution.

Figure A3. Share Prices around Volkswagen Emissions Scandal



Notes: Figure A3 shows share prices of big automobile firms and DAX (German leading index) around the Volkswagen emissions scandal of September 18, 2015. The share prices represent closing prices of the mentioned date and are portrayed relative to the share price on September 16, 2015 to simplify the comparison between firms. Figure A3 depicts a big decline for Volkswagen and other German automakers whereas non-German firms and the market exhibit a more stable performance.

Table A1. Variable Definitions

Measure of Capital Market Reaction	
CAR	Cumulated abnormal returns, 7 day centered unless otherwise indicated
Perceived Levels of Tax Avoidance	
CASH ETR	*txpd* / *pi*; income taxes paid over pretax income
GAAP ETR	*txt* / (*pi* – *spi*); total income taxes over for special items adjusted pretax income
VOLATILITY	Three-year standard deviation of the annual CASH ETR
Firm Characteristics	
SIZE	log (*at*); logarithm of total assets in U.S. Dollar
ROA (Profitability / Return on Assets)	*pi* / *at*; pretax income over total assets
LEV (Leverage)	*dlc* / *at*; total debt in current liabilities over total assets

Notes: Table A1 shows variable definitions. *Compustat* data items are in italic.

Table A2. *Sample Firms*

LuxLeaks firms included in baseline sample							
Company name	Country	Industry	Sample 2	Company name	Country	Industry	Sample 2
3I GROUP PLC	GBR	Other (Fin.)	x	HUTCHISON	HKG	High Tech	x
ABBOTT LABORATORIES	USA	Health	x	HYPO REAL	DEU	Other (Fin.)	
ABS-CBN	PHL	High Tech	x	ICAP PLC	GBR	Other (Fin.)	
ACCENTURE PLC	IRL	Other	x	INFORMA PLC	GBR	Consumer	
ALLERGAN PLC	USA	Health		INTELSAT	LUX	High Tech	
ALLIANZ SE	DEU	Other (Fin.)	x	INTERPUBLIC GROUP OF COS	USA	Other	x
AMAZON.COM INC	USA	Consumer	x	INTESA SANPAOLO SPA	ITA	Other (Fin.)	
AMERICAN INTERNATIONAL	USA	Other (Fin.)	x	INTL FLAVORS & FRAGRANCES	USA	Manufacturing	x
AMERIPRISE FINANCIAL INC	USA	Other (Fin.)	x	JAZZ PHARM	IRL	Health	x
AMP CAPITA	AUS	Other (Fin.)	x	JONES LANG LASALLE INC	USA	Other (Fin.)	x
AOZORA BANK LTD	JPN	Other (Fin.)	x	JULIUS BAER GRUPPE AG	CHE	Other (Fin.)	x
APOLLO GLOBAL MANAGEMENT	USA	Other (Fin.)	x	LAGARDERE (GROUPE)	FRA	Consumer	x
APPLE INC	USA	High Tech	x	LANDESBANK	DEU	Other (Fin.)	
AVERY DENNISON CORP	USA	Manufacturing	x	LEHMAN BROTHERS HOLDINGS INC	USA	-	
AVIVA PLC	GBR	Other (Fin.)	x	LVMH MOET HENNESSY LOUIS V	FRA	Consumer	x
AXA SA	FRA	Other (Fin.)	x	MACQUARIE GROUP LTD	AUS	Other (Fin.)	
BALL CORP	USA	Manufacturing	x	MCGRAW HILL FINANCIAL	USA	Other	
BALOISE HOLDING	CHE	Other (Fin.)	x	MERCK KGAA	DEU	Health	x
BANCA POPOLARE EMILIA	ITA	Other (Fin.)		METTLER-TOLEDO INTL INC	USA	High Tech	x
BANK OF AMERICA CORP	USA	Other (Fin.)	x	MYLAN NV	GBR	Health	x
BANQUE DEG	BEL	Other (Fin.)	x	NAVISTAR INTERNATIONAL CORP	USA	Consumer	
BARCLAYS PLC	GBR	Other (Fin.)		NEXT PLC	GBR	Consumer	x
BAYTEX ENERGY CORP	CAN	Manufacturing		NIKKO CORD	JPN	-	
BERKSHIRE HATHAWAY	USA	Other	x	NIPPON SHEET GLASS CO LTD	JPN	Manufacturing	
BLACKSTONE GROUP LP	USA	Other (Fin.)	x	NISSHINBO HOLDINGS INC	JPN	Consumer	x
BNP PARIBAS	FRA	Other (Fin.)	x	NORDSON CORP	USA	Manufacturing	x
BRITISH AMER TOBACCO PLC	GBR	Consumer	x	OAKTREE CAPITAL GROUP LLC	USA	Other (Fin.)	x
BROOKFIELD ASSET MANAGEMENT	CAN	Other (Fin.)	x	OFFICE DEPOT INC	USA	Consumer	
BUCHER INDUSTRIES AG	CHE	Manufacturing	x	PROCTER & GAMBLE CO	USA	Manufacturing	x
BURBERRY GROUP PLC	GBR	Consumer	x	PROLOGIS INC	USA	Other (Fin.)	x
CARLYLE GROUP LP	USA	Other (Fin.)	x	PROSPECTOR OFFSHORE DRILLING	LUX	Manufacturing	
CATERPILLAR INC	USA	Manufacturing	x	PRUDENTIAL PLC	GBR	Other (Fin.)	x
CBRE GROUP INC	USA	Other (Fin.)	x	QUILVEST SA	LUX	Other (Fin.)	x
CIRCOR INTL INC	USA	Manufacturing	x	RECKITT BENCKISER GROUP PLC	GBR	Manufacturing	x
CITIGROUP INC	USA	Other (Fin.)	x	ROSEBUD RE	ISR	Other (Fin.)	
CLIFFS NATURAL RESOURCES INC	USA	Other	x	ROTHSCHILD AND CO SCA	FRA	Other (Fin.)	x
CNP ASSURANCES SA	FRA	Other (Fin.)	x	ROWAN COMPANIES PLC	USA	Manufacturing	
COACH INC	USA	Consumer	x	ROYAL BANK OF CANADA	CAN	Other (Fin.)	x
COCA-COLA HBC AG	CHE	Consumer	x	SAN PAOLO	ITA	Other (Fin.)	
COMMERZBANK	DEU	Other (Fin.)		SBERBANK OF RUSSIA OJSC	RUS	Other (Fin.)	x
COMPASS GROUP PLC	GBR	Consumer	x	SCHRODERS PLC	GBR	Other (Fin.)	x
COVIDIEN D	IRL	Health	x	SHIRE PLC	IRL	Health	x
CREDIT SUISSE GROUP	CHE	Other (Fin.)	x	SINOPEC EN	CHN	Manufacturing	x
DEAN FOODS CO	USA	Consumer		SKANDINAVISKA ENSKILDA BANK	SWE	Other (Fin.)	x
DEUTSCHE BANK AG	DEU	Other (Fin.)		SOCFINAL	LUX	Consumer	
DEVELOPER	USA	Other (Fin.)		STABILUS SA	LUX	Consumer	
DEXIA SA	BEL	Other (Fin.)	x	STAPLES INC	USA	Consumer	
DMG MORI AG	DEU	Manufacturing	x	STATE STREET CORP	USA	Other (Fin.)	x
DNB ASA	NOR	Other (Fin.)		SUBSEA 7 SA	GBR	Manufacturing	x
DST SYSTEMS INC	USA	High Tech	x	SYKES ENTERPRISES INC	USA	High Tech	x
DUET GROUP	AUS	Manufacturing	x	TAYLOR WIMPEY PLC	GBR	Other	
E.ON SE	DEU	Other	x	TE CONNECTIVITY LTD	CHE	High Tech	x
EMULEX CORP	USA	High Tech		TELE2 AB	SWE	High Tech	x
EQT CORP	USA	Manufacturing	x	TELENET GROUP HOLDING N.V.	BEL	High Tech	x
EUROHOLD B	BGR	Other (Fin.)		TEMENOS GROUP AG	CHE	High Tech	x
EVRAZ PLC	GBR	Manufacturing		TEVA PHARMACEUTICALS	ISR	Health	x
EXPERIAN PLC	IRL	High Tech	x	TITAN INTERNATIONAL INC	USA	Manufacturing	
FAIRFAX FINANCIAL HOLDINGS	CAN	Other (Fin.)		TYCO INTERNATIONAL PLC	IRL	High Tech	x
FEDEX CORP	USA	Other	x	UBM PLC	GBR	Other	x
FINMECCANICA SPA	ITA	Manufacturing		UBS AG	CHE	Other (Fin.)	x
FONCIERE INEA	FRA	Other (Fin.)		UN HOLDING	IRL	Other (Fin.)	
FOYER DEAD	LUX	Other (Fin.)		UNICREDIT SPA	ITA	Other (Fin.)	
GATE GROUP HLDGS AG	CHE	Consumer	x	UNIONE DI BANCHE ITALIANE	ITA	Other (Fin.)	
GAZPROM PJSC	RUS	Manufacturing	x	UNITED TECHNOLOGIES CORP	USA	Manufacturing	x
GENERAL ELECTRIC CO	USA	Other	x	VERIZON COMMUNICATIONS INC	USA	High Tech	x
GIGAMEDIA	TWN	High Tech		VERMILION ENERGY INC	CAN	Manufacturing	x
GLANBIA PLC	IRL	Health	x	VITEC GROUP PLC	GBR	Manufacturing	x
GLAXOSMITHKLINE PLC	GBR	Health	x	VODAFONE GROUP PLC	GBR	High Tech	
GOODMAN GROUP	AUS	Other (Fin.)	x	VOLKSWAGEN AG	DEU	Consumer	x
GROUPE BRUXELLES LAMBERT	BEL	Other (Fin.)	x	WEATHERFOR	CHE	Manufacturing	
HENDERSON GROUP PLC	GBR	Other (Fin.)	x	WENDEL	FRA	Other	x
HRG GROUP INC	USA	High Tech	x	WGZ BK.GSH	DEU	Other (Fin.)	x
HSBC HLDGS PLC	GBR	Other (Fin.)	x	WOLSELEY PLC	CHE	Consumer	x
HUHTAMAKI OYJ	FIN	Manufacturing	x	YAMANA GOLD INC	CAN	Other	

Notes: Table A2 presents a list of all firms included in sample 1 as well as sample 2.

Table A3. Exclusion of Outliers

CARs applying the market model				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
Window length: -3/+3	146	0.0043	0.0029	0.0042
Window length: -2/+2	146	0.0120	0.0034***	0.0057**
Window length: 0/+3	146	0.0050	0.0026*	0.0071

Notes: Table A3 presents cumulated abnormal returns for the baseline sample. The results are shown for varying window lengths. In contrast to table 4, we exclude corporations whose CAR is in the lowest and highest percent of the respective CAR distribution. We consider the market model to calculate abnormal returns. In an additional column, we report standard errors adjusted for cross-correlation according to Kolari and Pynnönen (2010). *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

Table A4. CARs for Different Levels of Tax Risk

CARs applying the market model				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
VOLATILITY below 25th percentile	21	0.0177	0.0065***	0.0066***
VOLATILITY above 25th percentile and below median	21	0.0075	0.0070	0.0069
VOLATILITY above median and below 75th percentile	21	-0.0007	0.0101	0.0054
VOLATILITY above 75th percentile	20	0.0213	0.0107**	0.0149

Notes: Table A4 presents mean cumulated abnormal returns for different levels of CASH ETR Volatility. VOLATILITY is the three-year standard deviation of the annual CASH ETR measure. We consider the market model to calculate abnormal returns. In an additional column, we report standard errors adjusted for cross-correlation according to Kolari and Pynnönen (2010). *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

Table A5. Additional Tests regarding the Potential Removal of Tax Benefits

Panel A: Tax avoidance measured by CASH ETR				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
CASH ETR below 25th percentile	26	-0.0005	0.0072	0.0010
CASH ETR above 25th percentile and below median	26	0.0145	0.0079*	0.0080*
CASH ETR above median and below 75th percentile	26	0.0078	0.0077	0.0128
CASH ETR above 75th percentile	25	-0.0064	0.0129	0.0088
Panel B: Tax avoidance measured by GAAP ETR				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
GAAP ETR below 25th percentile	30	-0.0098	0.0106	0.0237
GAAP ETR above 25th percentile and below median	30	0.0081	0.0082	0.0157
GAAP ETR above median and below 75th percentile	30	0.0021	0.0076	0.0021
GAAP ETR above 75th percentile	30	-0.0079	0.0084	0.0515
Panel C: Mean CARs of U.S. Firms				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
Window length: -2/+2	44	-0.0010	0.0006	0.0025
Window length: -3/+3	44	-0.0078	0.0070	1.6804
Window length: 0/+3	44	-0.0039	0.0052	0.0120
Panel D: Mean CARs of EU Firms				
	# of firms	Mean CAR	Std. err.	Adjusted std. err.
Window length: -2/+2	69	-0.0025	0.0044	0.0115
Window length: -3/+3	69	0.0017	0.0052	0.0021
Window length: 0/+3	69	0.0002	0.0039	0.0005

Notes: Table A5 presents results of additional t-tests to test a potential effect due to a rising litigation risk. CARs are the mean cumulated abnormal returns for the baseline sample. We consider the market model to calculate abnormal returns. In panel A and B, we test the significance of CARs for varying levels of tax avoidance measured by CASH ETR and GAAP ETR. We use the same groups as in table 6. Panel C and D differentiate between U.S. and EU firms. The number of firms differs slightly to our previous baseline sample due to availability of price information. All results are shown for varying window lengths. In an additional column, we report standard errors adjusted for cross-correlation according to Kolari and Pynnönen (2010). *, **, and *** show significance at the level of 10 %, 5 %, and 1 %, respectively.

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